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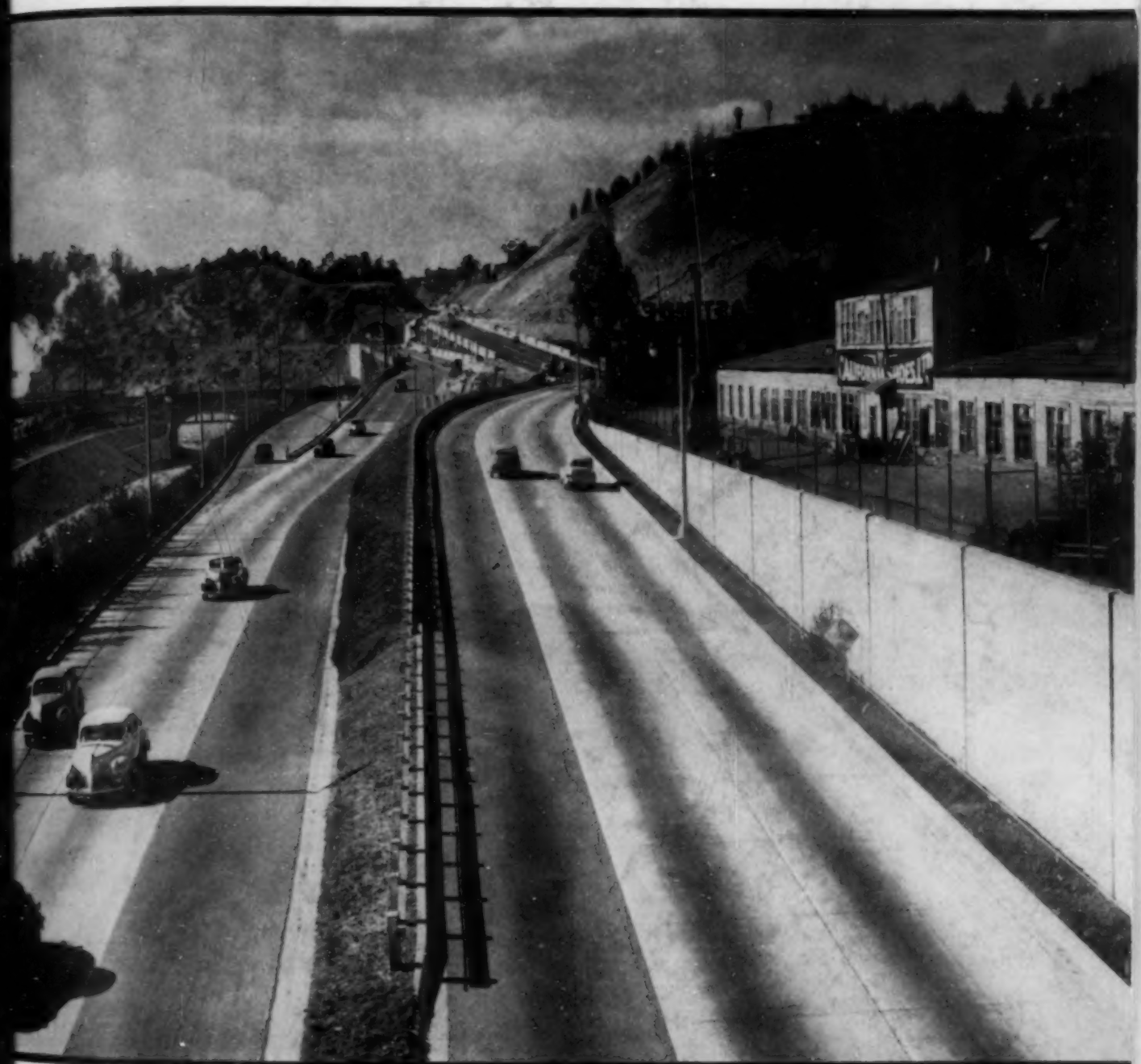

A Continuing Highway Construction Program Is an Economic Stabilizer—See Article, Page 340

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

AUGUST 1946

Among Our Writers

JOHN W. HAW (U. of Minn. '09), following work as a county agricultural agent and state leader of county agents in North Dakota, in 1924 was appointed agricultural development agent by the Northern Pacific Ry. Since 1927 he has been director of its whole Dept. of Agricultural Development. With F. E. Schmitt, in 1934, he prepared an economic appraisal of all federal irrigation projects, embodied in the Haw-Schmitt report to Secretary of Interior Ickes.

CHARLES M. UPHAM (Tufts Col., B.S. in C.E. '08, M.S.; U. of N.C., C.E.) has had extensive experience in the highway field. Posts he has filled include chief engr. of the Coleman du Pont Road (Delaware), the Del. Highway Commission, and the N.C. Highway Commission; Sec'y, A.A.S.H.O.; Director, Highway Research Board. Since 1926 he has been Engr.-Director, Am. Road Builders' Assoc., besides doing consulting work in this country, Mexico, and Cuba.

R. A. WORK (U. of Calif., B.S. Agriculture '27) was a professor at Oregon State College and Supt. of Medford Branch Experiment Station for 11 years. He is now Senior Irrigation Engr., Div. of Irrigation, Soil Conservation Service, U.S. Dept. of Agriculture, in charge of that agency's snow surveys. For 1944–1946 he is chairman of the executive committee, Western Snow Conference.

F. B. FARQUHARSON (U. of Wash. '23) joined the faculty at that university in 1925 and is now in charge of the Structural Testing Laboratory and is also Director of the Engineering Experiment Station. Having finished a long series of studies on the Tacoma Narrows Suspension Bridge, he is now engaged in continued studies on suspension bridges in general.

R. E. HICKSON (U. of Ore. '09) was engaged on the design, construction, and rehabilitation of ocean jetties at the mouth of the Columbia River and other West Coast ports, then on design and construction of the 35-ft ship channel of the Columbia, The Dalles-Celilo Canal and locks, and improvement of other inland waterways. At present he is Chief, Eng. Div., Portland, Ore., District, Corps of Engineers.

RICHARD G. TYLER (U. of Tex. '08; M.I.T. '10) has had 31 years of teaching experience, including 17 at the U. of Washington, where he is professor of sanitary engineering. His consulting practice has included the design of sewage deposal plants and water works, and research on the treatment of industrial wastes. He holds two patents on the treatment of sewage and sulfite waste liquor, and has contributed to the writing of several textbooks in his field.

EDWIN F. LEVY (U. of Calif., B.S. '27) has been with the Calif. Div. of Highways, San Francisco–Oakland Bay Bridge office, since 1932, following 5 years of general construction experience. Until 1939 he was in the design div. for bridge and railway facilities, then transferred to the administration office for the maintenance and operation of the bridge.

LEE MCALLISTER (Ore. State Col., B.S. in C.E. '24) had been chief of Oregon's Div. of Dams and Hydraulic Structures for 10 years when he entered the service of the Bur. of Reclamation in 1941. In 1943 he was transferred to the Salem, Ore., Project Planning Office, where he is now Asst. Project Planning Engr. Investigations of irrigation possibilities west of the Cascades are under the direct supervision of this office.

VOLUME 16 NUMBER 8

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VOLUME 16 AUGUST 1946 NUMBER 8

Stewardship of Professionalism Given High Priority

Annual Address of the President Delivered at Spokane Convention

By W. W. HORNER, PRESIDENT ASCE
CONSULTING ENGINEER, ST. LOUIS, MO.

DIRECTING his remarks particularly to members of ASCE who are young in years or in spirit, President Horner chose the subject of professional growth of engineers for his Annual Address to the Society. While the aspects of the subject are broad, his analysis cut directly to the point, placing responsibility for professional welfare on the shoulders of each member of the profession. This account is a condensation of the full address.

NOT long ago there came my way an opportunity for a man-to-man talk with members of a Student Chapter of the Society. It was a heart-warming and revealing experience, and one that stimulated my thinking on the subject of our younger members.

I asked them if, in the light of recent events and developments, they had felt at all inclined to reconsider their decision to enter the engineering profession. Had they, I inquired, ever thought that there might be a greater reward in a craft under the protection of organized labor?

The replies I received were most definite. Theirs was no philosophy of doubt or compromise, in which "higher wages now" were to compensate for inhibition of initiative. They were concerned with fundamentals—opportunities for the future, salaries commensurate with professional status, and a satisfactory scale of living to reward them for their years of study, learning, and development into the careers of their choice.

And they were equally forthright in their inquiries as to what assistance they could look for from the older and established members of the engineering profession. What had the profession done to help them? What was it doing to assure them a fair chance? What were its plans for future aid to the younger fellows?

W. W. HORNER, PRESIDENT OF ASCE

It was obvious that they weren't too well satisfied with what they had heard and that there was grave doubt in their minds that we elders had done all that it was possible for us to do. They inferred that possibly we had been sticking too close to our personal knitting and, by implication, asked whether we had not failed to develop a professional feeling to a reasonable degree.

AN EXPLANATION CALLED FOR

Under the cross-examination of these straight-thinking young men, my derelictions were beginning to appear in the record, and I found myself feeling apologetic and definitely on the defensive. It became apparent that I, and not they, needed to reflect and reconsider.

I have done this at some length and have concluded, for myself and my contemporaries in the profession, that perhaps it is best that we plead guilty and ask the clemency of the new generation, who are so sure of themselves and so ready and willing to take over.

In throwing ourselves on the mercy of the court, so to speak, I think it just, however, that we be permitted to offer an explanation—hardly an excuse—for our conduct of our professional affairs to date. I think a review of such extenuating and mitigating circumstances as may be found to exist is in order at such a time, and I think, also, that I can best present it in terms of my own experience.

When I entered the Junior grade of membership in ASCE, America was emerging from the gay nineties and plunging into the ensuing railroad panic of 1907. Immigration was still at high tide. Labor was plentiful and practically unorganized. Business and industry were enjoying freedoms they long since have lost—were, in fact, abusing their privileges in a manner so ruthless that it could lead nowhere but to the curtailment and abrogation of those privileges. Controls were instituted not only as the need for them arose, but in most instances only after the abuses were so flagrant as to cause the people to wonder if the means of abolishing them were to be forthcoming in time to avert national calamity.

The American Society of Civil Engineers then was to the young man an order of eminent mystics who met primarily to compare notes on great achievements. Then the Junior was received into the Society after careful

scrutiny and was thereafter seen, but for some time, not heard. Then, as now, the Junior needed a friend and friendly help, but the devil took the hindmost.

We Juniors did have impressed upon us sound ideas of professional integrity and an understanding that the results of our work must be always in the public interest. But the notion that we should devote some time to social and economic improvement of the membership was not advanced in any manner whatsoever. Individual engineers carried through classic projects and made great contributions to technological advance. Many members of the Society rendered conspicuous public service, and the profession profited and grew in the public esteem.

It is evident that we had little training in the service of the profession. The important social and economic side was at best a spare-time sideline for comparatively few members of the Society. Wiser heads recognized the need for enhancing the status of the profession, and occasionally voices sought to be heard on the subject. But the membership was busy, and the voices were heard but briefly and ineffectually. We were immersed so deeply in our individual improvement problems that for a long time we did not recognize the benefits or the essentiality of improving our position as a profession.

When it did come, our awakening was a gradual process. We created the Engineers' Council for Professional Development and supported it after a fashion. We saw the light on the need for legal recognition of the profession in the public interest, and got together to put through state registration. Our committee work began to point out somewhat more strongly the need for such things as professional recognition and adequate salaries and fees.

MAJOR CONTRIBUTION MADE

In summary, we gave ourselves wholeheartedly to our engineering work; we made major contributions to developing the United States into the greatest and most capable nation of the world, a condition which was to stand her, and us, in good stead when the second World War required of us that we be the arsenal of democracy. So we had little time to organize ourelves as a profession. Yet some members—a small part of our Society, and all too few—worked in that direction. In the last decade particularly, some orderly procedure has been developing.

The need for unity in the profession as a whole has resulted in the federation of Society Sections with other engineering bodies in the metropolitan areas and in some of the states. Most recently, Engineers Joint Council (more about which a little later) has met, at least in part, the need for unified action on the national level and has proved to its five constituent societies that they have much in common, can work together in harmony, and in doing so can render public service of a higher order than has heretofore been possible.

We have in our Society, and with our affiliations, created the skeleton of good professional organization. At the present time, that organization is undermanned; too few of us are actively engaged in the relatively new task of molding firm flesh onto that skeleton. Too many of the older members retain their earlier individualistic tendencies, and too many of all ages are too busy with private affairs, thus bidding fair to repeat the errors of our earlier ways to which I am now, as I stated, pleading guilty.

PROFESSION NEEDS YOUNGER MEN

That is why I am especially pleased to see you younger men come into the picture. Your awareness of the social and political scene, your concentration on the intrinsic value of the professional attitude, your determination to see that matters you consider essential are acted upon, and the natural zest of youth that you bring with you, provide the new light and the new energy which should transform our slower progress into accelerated achievement.

Today, the organization of the American Society of Civil Engineers is well distributed over the country. Its foundations and its strength are in its Local Sections. Your real service to the profession must necessarily be applied there, and at that level it can be adjusted best to the circumstances of your job and your environment. You will find generally that your Section has both social and technical programs, and that you can participate in them and in arranging for them to good advantage. If, in some instances, they have not been well organized, there is a constructive service waiting for you.

Either in your Section programs or through your personal work you may find encouragement to enter civic or business organization, with the further opportunity of broadening your viewpoint while acting constructively for the public. Separately, there is opportunity here to demonstrate to the citizenry at large that the engineer has more than a one-track, technical mind.

In the past, Local Section activity has not been closely coordinated with matters of interest to the membership in the national field or of national legislation having a possible effect on the membership of the profession and its welfare. New procedure in this direction is now being developed. Your Board of Direction and its committees have been improving their work in this field and approaching the limits of what can be done by central bodies. To be fully effective, further development must be carried out by the whole membership, wherever it may be situated. Local Sections will find need to form committees on national affairs and to work very closely with the new National Affairs Committee of the Society. This latter is developing action procedure intended to give force to, and to seek results under, the broader policies which the Society is, from time to time, approving. It is not at all unlikely that some of the more forward-looking of our younger men may be called upon to join panels which will present the engineers' viewpoint to legislators.

I trust that in this account of the older engineer's stewardship of the welfare of our profession you find cause for agreement that, while we have given less than the desired attention to that subject, this field of endeavor has not been wholly neglected by us, and that it is now given a high priority on the program of your Board. Further, we have developed a deep and sincere conviction of your ability to complete the job in a way that will be satisfactory to you, and to that end we are prepared to stay in the game even more effectively than heretofore. Full success requires your leadership.

E.J.C. REPORT CITED

It is my fond hope that as you ascend to that leadership, and as we turn it over to you, we both may profit by the experiences which we older men have had.

An excellent example of the advances that have been made toward obtaining for the engineering profession the recognition we all desire for it, and one which bids fair to open new avenues for recognized public service, is provided by the recent report on industrial disarmament of Japan (see CIVIL ENGINEERING for July 1946, page 292), sponsored by Engineers Joint Council.

What strikes me as particularly significant, however, and as a milestone in our progress toward the kind of public recognition that will er-

tend the engineer's scope of usefulness to the public incalculably, is an editorial that appeared in *The New York Times* on June 15, within a day or two after the Japanese report was made public.

Under the heading, "A National Resource," *The Times* stated editorially:

"The National Engineers Committee was appointed in February 1945, by representatives of the five national engineering societies at the request of the then Secretary of State, Mr. Stettinius, to bring the best American engineering thought to bear on the problem of the industrial disarmament of aggressor states. Last September it completed a report on Germany (see CIVIL ENGINEERING for November 1945, page 524) the recommendations of which were substantially all included in the directive of the Allied Control Council of last March 29 for the limitation and control of German industry. Now its report on Japan has been made public in Washington, with the hearty endorsement of the State, War, and Navy departments, as well as that of General MacArthur. It thus clearly foreshadows long-range American policy toward our defeated enemy in the Pacific . . . .

"One of the most striking things about the present report is nowhere to be found in it, able document though it is. This is the availability for national purposes of such organized entities as the engineering profession, whose technical competence is matched by their freedom from any suspicion of political motivation. General Clay has acknowledged that the report on Germany has been his most effective instrument in dealing with both the British and the Russians. The latter, in particular, trust American technologists, whereas they look with suspicion upon our diplomats. Our own government might do well to utilize even more fully such a national resource."

GREAT OPPORTUNITY FOR SERVICE

With such recognition, in its infant stage though it is, as a beginning, to what limitless heights may we not aspire for our profession as a whole? If the non-technical segment of our population is commencing to visualize the engineering profession as "a national resource," must we not find inspirational hope for our profession in such stirrings of acceptance and recognition? As engineers, we have known for a long time, of course, that there are many additional services we can render. This latest and so clearly stated recognition of our potential by non-technical men, coming as it does at a time when our younger men are so ready and able to assume their position in the affairs of our Society, seems to me to make for an ideal situation and to provide added stimulus to the ambitions of our younger men.

I am convinced that the time has come when the work in the field of professional improvement can no longer be that of a few committees, but must be the business of the entire membership, with much of the work done at the Local Section level, and by younger members. There, you younger men will find full opportunity to render service to the public, to the profession, and particularly to your generation of engineers.

Preferred Treatment Advocated for Reclamation Funds

Vital Role of Irrigated Agriculture in Nation's Economy Stressed

By JOHN W. HAW
DIRECTOR, AGRICULTURAL DEVELOPMENT DEPARTMENT, NORTHERN PACIFIC RAILWAY

TIME is running out on generous federal expenditures for extensive public works construction and there is every indication that the reclamation program will be brought up at the crossroads in the next Congress.

GENEROUS APPROPRIATION PROVIDED

National reclamation fared rather well at the hands of appropriating bodies in this Congress. After due deliberation by legislative bodies, $113,610,803 was agreed upon as the amount this nation can afford to spend in fiscal 1947 on projects having as their dominant purpose the irrigation of arid Western lands. An expenditure in fiscal 1947 is thus shortly to be authorized which is three times the 1946, and six times the 1945 appropriation, and the largest ever made available in a regular appropriation bill. Large compared to recent appropriations, it is nevertheless far from the sums required yearly to carry forward the Bureau's carefully engineered construction program to its 1952 objective. This program calls for the following appropriations in millions: 333 in 1948, 317 in 1949, 221 in 1950, 154 in 1951, and 78 in 1952.

AT this time when food is most critically needed, the produce from irrigated areas in the arid regions demonstrates the place of reclamation in our expanding economy. Citing the benefits to be realized from the construction of new irrigation facilities, Mr. Haw outlined for the Spokane Annual Convention the justification for such developments, based on their contribution to our future food and fibre supply. He pointed out that irrigation deserves "preferred treatment" in the public works program.

The generosity toward reclamation of this Congress was apparently not so much a result of recognition of the merit and need for vigorous prosecution of irrigation construction as it was a matter of cutting the postwar public works cake. During the war, the Bureau of the Budget and Congress acquired the habit of ladling out government department and bureau appropriations in billions and hundreds of millions. It has been a heady business, and furthermore it is notoriously hard to part with custom and habit and institute a program of retrenchment.

However, it is strongly suspected that, in the Bureau of the Budget and in the Congress which convenes in January 1947, economy will be the watchword, and blue pencils will really get down to business. As a result, it is reasonably safe to predict that national reclamation will reach a crossroads early in 1947. That crossroads will be whether Congress will begin a policy of providing the Bureau of Reclamation with a yearly dribble of money to barely maintain incompleted projects in work, reserving a full-speed program to cushion a deflationary period, or whether on the other hand, it will segregate reclamation from other types of public works and accord it preferred appropriation treatment.

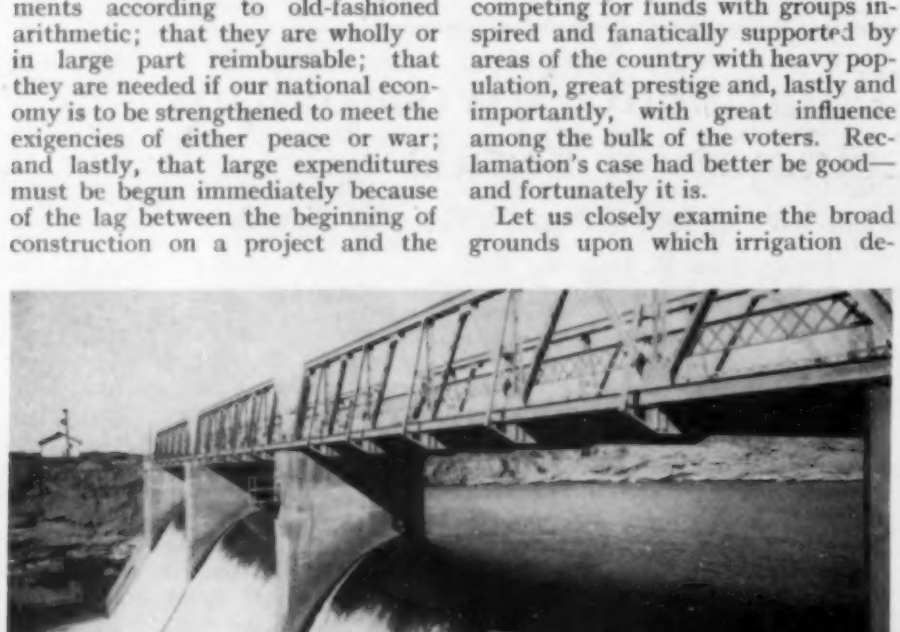
IRRIGATION TRANSFORMS ARID WASTES (LEFT) INTO PRODUCTIVE FARMS (RIGHT)

The latter is on the basis that it is a unique regenerative federal activity, dynamic in its effect upon all business and all sections of the country, and an economic necessity if this nation in the future is to properly clothe and feed its steadily increasing population without resort to foreign imports badly needed elsewhere.

The case for future reclamation expenditures must be based on arguments that they are sound investments according to old-fashioned arithmetic; that they are wholly or in large part reimbursable; that they are needed if our national economy is to be strengthened to meet the exigencies of either peace or war; and lastly, that large expenditures must be begun immediately because of the lag between the beginning of construction on a project and the final realization of its contribution to our economy.

Reclamationists understand quite well that their claims for that part of the tax dollar available for public works will meet stiff competition. Proponents of highway and airport construction and improvement, river and harbor improvement, and public buildings are all confidently expected to present and press their claims for available funds. Reclamation will be competing for funds with groups inspired and fanatically supported by areas of the country with heavy population, great prestige and, lastly and importantly, with great influence among the bulk of the voters. Reclamation's case had better be good—and fortunately it is.

Let us closely examine the broad grounds upon which irrigation development rests its case for preferred treatment and justifies its contention for a large cut of the taxpayer's dollar set aside for public works in this postwar period.



IRRIGATION STRUCTURES HAVE AN IMPORTANT PLACE IN OUR EXPANDING ECONOMY
Willwood Diversion Dam, Shoshone Project, Wyoming

MANY MULTI-PURPOSE PROJECTS

First, the Bureau of Reclamation's program is largely composed of multiple-purpose projects embodying the irrigation of land and the development of hydroelectric power, both of which repay construction cost and absorb their operation and maintenance expenses. Power pays interest on the investment as well. Irrigation is not required under present legislation to meet an interest charge for the following reason: It is generally conceded that the civilization arising as a result of irrigated land, generates income and property subject to various forms of state and national taxation, and taxes so derived have proved over the years to be greatly in excess of the interest payment to the government on irrigation construction costs. Flood control, aid to navigation, and the provision of recreational facilities are also by-products of most multiple-purpose reclamation projects.

The fact remains that, except for these public benefits, the government is merely lending water and power users the money with which to build river-control and water-use structures. The record of principal repayment to date on most irrigation and power projects leads conclusively to the verdict that they have proved smart investments.

TAXATION BASE EXPANDED

Second, no question is more pertinent to ask of public works proponents than "Will the project seeking authorization result finally in contracting or expanding the taxation base?" As to reclamation projects, we can speak with uncontestable assurance on this point. Consider

the Salt River Valley in Arizona, the Boise Valley in Idaho, the Yellowstone in Montana, the North Platte in Nebraska, and the Yakima in Washington. Without irrigation the only productive enterprises in these valleys would be unstable range livestock operations and erratic, large-scale, dry-farming gambles. Taxes derived from such ventures, at least federal forms of taxation, would not heat the Pentagon Building.

On the other hand, with an expenditure of $37,620,899, federal reclamation works have brought irrigation water to 420,000 acres of land in the Yakima valley. On several divisions of this project the construction debt has already been almost completely repaid. Products of agriculture were raised on irrigated land in this valley in 1945 valued at $77,923,283. Thus, when food is more critically needed than at any time since the Civil War, a project which cost 37 million dollars and which has repaid 24.6% of its cost, yielded in one year agricultural produce valued at over twice the original government investment. On the Tieton Division of the Yakima project, costing less than $100 per acre to construct, $853 was the average gross value per acre of the products produced in 1945, and its original debt for construction is 99.2% paid. Similar cases are numerous.

KEY TO RECLAMATION IS CONSTRUCTION OF COSTLY CONTROL WORKS SUCH AS BARTLETT DAM ON THE VERDE RIVER IN ARIZONA

VALUE RECEIVED

Considered in the aggregate, the government has invested 312 million dollars in irrigation projects in the past 44 years, of which already 67 millions have been repaid by water users. In 1945 the value of agricultural products which these projects poured into the present hungry channels of trade was 411 million, or 129% of the total cost of the irrigation facilities serving them. It should be emphasized that this is new national wealth derived from soil and air and the farmers' labor, and passes through many hands in our modern civilization. Some economists say the farm dollar revolves seven times before it comes to rest in the U.S. Treasury, in capital investments, or in the safety deposit box.

From the new wealth generated by Western irrigation projects flows a whole succession of taxes levied on the incomes of producer, processor, transportation agency, wholesaler and retailer. Consider, in addition, the values for taxation purposes of the farmsteads that dot the valleys and the property values in smaller towns and villages that serve these rural districts as well as in cities such as Phoenix, Boise, Billings, North Platte, and Yakima. The tax-base broadening effects reach even further. Seventy-seven million dollars in wealth generated in the Yakima valley in one year steps up the tempo of the automotive industry in Detroit, the shoe industry in St. Louis, the farm-machinery industry in Chicago; to say nothing of its effect on business in the large trade and manufacturing centers near at hand such as Spokane, Seattle, and Portland.

As a permanent and reliable tax-base broadening investment of the federal government, no public works project comes to mind remotely approaching in merit the reclaiming of arid lands by irrigation.

Third, there are no public works which, on completion, immediately set up so numerous and so varied an array of opportunities for a livelihood. First come opportunities for farmers and farm laborers. For instance, the 37-million-dollar investment in Yakima valley irrigation works has already created 10,063 farms under its ditches, and 37,399 people live on these farms. The processing and marketing of the products of the farmers' labor and the servicing of their needs give rise to villages and towns peopled by small businessmen, craftsmen, doctors, lawyers, teachers, and preachers. At strategic intervals, fashioned by the confluence of railroads and highways, some one of the local trading centers gradually develops into a city of 25,000 to 35,000 population. The lifeblood of such cities flows directly and exclusively from the setting in motion of production on irrigation farms.

LASTING EMPLOYMENT GENERATED

While all types of public works provide employment during periods of construction to workers on the job,

WATER FOR IRRIGATION GENERATES WIDESPREAD EMPLOYMENT
Whalen Diversion Dam, North Platte Project, Nebraska-Wyoming

WATER FOR YAKIMA VALLEY CROPS RELEASED FROM NEEDLE VALVE OF TIETON DAM

to transportation agencies and suppliers of material, few if any generate any substantial employment after completion. All too many begin immediately to make further demands on the public purse for upkeep, and to the extent that they do create employment, it is a matter of subtracting from the pay rolls of private tax-paying businesses and transfer to the tax-supported pay rolls of state or nation.

Also to be emphasized in connection with employment is the minor power by-product of some of the older irrigation projects and the important power by-product of practically all large projects now authorized for construction or under study and investigation. Power made available in large quantities in this area of meager and widely spaced coal resources is destined to be an important magnet in attracting industries that process the bulky or weighty raw materials of forests, mines, and farms located in this Western country.

Fourth, the most important reason for selecting reclamation for preferred treatment by appropriating bodies is its contribution to a sound national economy and a secure and adequate future food supply. As of today, and assuming a return to long-time average weather conditions, consumption of most farm products has already overtaken supply. As to meat animals, dairy products and fats and oils — domestic consumption has not only overtaken but has passed supply, as every food shopper from Seattle to Miami will testify.

NEED FOR AGRICULTURAL ACREAGE

The blunt fact is that in 1930 we were feeding 122,775,046 people in this country from 365,035,000 harvested crop acres, or 2.97 acres per capita. In 1945 population had increased to 139,621,000, an increase in 15 years of 16,845,954, and this increased population was being fed from the product of 351,000,000 harvested crop acres, or 14,000,000 fewer acres. This comes out as 2.51 acres per capita, or 0.46 fewer acres per capita than 15 years ago. Experts are now predicting a population in 1970—24 years hence—of 157,442,000 or 17,821,000 more than at present. While this may not be anything to be wildly excited about, it is something to give us grave concern as evidence of a trend with serious future implications.

TO SAVE TRANSPORTATION COSTS

When we examine the food-supply situation regionally in the Western states, apprehension deepens. It must be remembered that population west of the continental divide is now and will increasingly in the future be largely concentrated in the coast states of California, Oregon and Washington. Unless the seven Pacific Slope states have a reasonable degree of self-sufficiency as to bulky, staple articles of food, they are seriously handicapped as to living costs through assessment of necessarily heavy transportation costs to import such foods from the Mississippi Valley states.

Let us take stock of the supply and demand situation in the Western region. Population growth in the 24 years between 1920 and 1944 in these seven Pacific Slope states increased from 6.8 million to 13.9 million, or 103.4%. In the same period and same area, harvested-crop acreage declined from 20.4 million to 19 million, or 5.6%. Regionally there is now available for crop production only 1.1 acres per capita as compared to 2.8 acres 24 years ago. This is a situation about which to be genuinely alarmed.

INCREASING POPULATION ESTIMATED

Projecting the rate of growth between 1920 and 1940 into the future, population experts assert that by 1970 this seven-state Pacific Slope area will be the home of approximately 18 million people, or an increase of 4 million. How is this additional population to be fed with the area now rapidly drifting to an import basis on most foods excepting fruits, vegetables, nuts, and other specialties? It must come, if at all, from irrigation development as areas cleared of stumps or drained will no more than offset those retired through erosion, industry, residential encroachment and other causes.

The conclusion is inescapable that to supply locally the needs of a population increasing in the West at 2½ times the national rate, and at the same time to provide the increasing population of the Middle West and East with the type of specialty food crops that can only be grown under Western irrigation, the program of reclamation must get the green light in the next decade from Congressional appropriating bodies.

Society Asks Freedom for Professional Men in Collective Bargaining Process

Congressional Committee Requested to Change Existing Labor Law

THE right to bargain collectively, the right to bargain individually, and the right to employment without joining a union are held to be basic rights for professional employees. In maintaining this position, the American Society of Civil Engineers has striven to define clearly the meaning of "professional" as opposed to "sub-professional." A ready-made criterion for separating out professionals exists in the system of engineering registration by the States. This basis was offered a Congressional committee during hearings which, it is hoped, will result in revised labor legislation.

THREE specific points of fundamental importance to professional engineers have been proposed for consideration in drafting new labor laws. Appearing before the Subcommittee of the House Labor Committee on July 10, E. L. Chandler presented a statement of objectives which are held to be essential to the protection of professional employees. Mr. Chandler is the Washington Representative of ASCE, and his statement was prepared jointly with William N. Carey, Secretary and Executive Officer of ASCE. The testimony, which was presented at the request of the Congressional subcommittee, also included the suggestion that State registration as a professional engineer be recognized as properly identifying those who are members of the profession. Mr. Chandler told the labor group that:

"The fundamental difficulty with present labor law as it affects professional employees is that it places professional employees and non-professional employees within one incompatible category. Their viewpoints and attitudes are inherently different.

"To require the application of the self-same standard of operations for professional men and non-professional men is not in the public interest. The output of professional employees cannot be standardized as can that of manual and skilled labor. It cannot be measured in terms such as the number of brick a man should lay in a given number of hours, the number of cubic yards of dirt that should be moved, the square yards of painting, the amount of type to be set, bolts to be placed, feet of conduit to be laid, or in terms of any other similar unit.

"We recognize the principle of collective bargaining to be a fundamental right of all employees, professional and non-professional. We deny, however, the right to require any employee to belong to any organization as a condition governing his employment. Such a condition, in our opinion, is evil when applied to non-professional labor, and when it is applied to professional employees, absorbed against their wills into bargaining units or trade unions, it is no less than vicious. In such cases the professional employees are usually a small minority in a large bargaining unit or trade union local, the majority of whose members have no community of thought or interest with professional employees.

"The background, education, training, and work interests of professional employees and non-professional employees are poles apart. It is futile to expect that a forced grouping of the professional and non-professional employees in any plant or organization could possibly form an 'appropriate bargaining unit.' Under present law and its administration, such plainly inappropriate groupings are made and, by fiat, are declared appropriate. We do not consider this to have been the intent of Congress. We believe that the law should be made so clear and explicit with regard to this matter as to eliminate the possibility of such grouping.

THREE RIGHTS OF PROFESSIONALS

"Consideration by your Committee is directed to three specific points which we believe are of fundamental importance for inclusion in any legislation which establishes standards for collective bargaining between employees and employer, viz:

"(1) Any group of professional employees, having a community of interest and who wish to bargain collectively, should be guaranteed the right to form and administer their own bargaining unit and be permitted free choice of their representatives to negotiate with their employer.

"(2) No professional employee, or group of employees, desiring to undertake collective bargaining with an employer, should be forced to affiliate with, or become members of, any bargaining group which includes non-professional employees, or to submit to representation by such a group or its designated agents.

"(3) No professional employee should be forced, against his desires, to join any labor organization as a condition of his employment or to sacrifice his right to individual, personal relations with his employer in matters of employment conditions.

"Legislation which would cover these three points, and cover them without possibility of contrary interpretation, would satisfy one of the avowed purposes of the present National Labor Relations Act.

"Many of the labor difficulties involving professional employees stem from a lack of general understanding of what constitutes a professional employee. Defining a 'professional employee' is not an easy task but an appropriate designation is not at all impossible. Permit us to present one designation. It may not be the best one, but it is practical and workable and would serve the purpose to some extent. We propose that State registration in a profession be accepted as prima facie evidence of professional status. Here, ready made, is an established criterion under which State Boards, legally constituted for the purpose, determine which applicants for licensure are, and which are not, qualified for public recognition as members of a profession.

"We believe that the labor statutes should carry a provision to the effect that no person licensed or otherwise legally authorized by any State to practice any profession shall be obligated, as a condition to his employment in the practice of his profession, to join any bargaining group; nor should he be forced to accept representation by any bargaining group. This would not deprive anyone of the right to join his fellows or to affiliate with any group for the purpose of bargaining collectively; nor would it deprive anyone of such benefits as are afforded by the present law.

"We are convinced that public interest would be served with the passage of new legislation or amendments to existing laws which would guarantee to professional employees the right of choosing, through their own votes, to organize or to refrain from organizing for collective bargaining purposes, the right to join or decline to join with other organizations dedicated to the same purpose."

Highway Construction and Our National Economy

Taken from Paper Presented Before the Highway Division at the Spokane Convention

By CHARLES M. UPHAM, M. ASCE
ENGINEER-DIRECTOR, AMERICAN ROAD BUILDERS' ASSOCIATION

WHILE highway construction was reduced to a near standstill during the war, planning did not stop. Most highway building agencies were busy in the development of programs designed to provide, in due course, modern highway and street facilities, nationwide in scope. While much of this work did not reach a stage of completion, a large volume was initiated and will show results as manpower increases and restricting influences diminish.

The size of the job ahead must of necessity exceed any road-building program previously attempted. The lapse in highway and street construction during the depression years and those following has resulted in a highway deficit which has been aggravated by yet another lapse in highway construction caused by the war. The cost of the construction needed to modernize the present highway system to accommodate present traffic is estimated to be from 16 to 20 billion dollars.

Highway construction, by providing facilities that are sorely needed to improve the nation's transportation system, benefits the nation's total economy. Along with this, and of equal importance, the construction activity itself is essential to the nation's welfare. Dollars spent on construction have a stimulating effect on every segment of the national economy.

That construction of all kinds exerts a maximum leverage or multiplying effect on industry has been proved (Fig. 1). An analysis of the effects of highway construction expenditures shows that for each dollar spent, three dollars worth of business results. This does not apply to hand-tool relief work such as WPA, where little is required in the nature of equipment and materials, but does apply to any type of substantial construction done by modern methods.

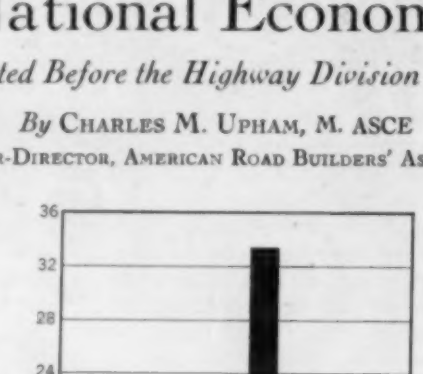


FIG. 1. DISTRIBUTION OF EXPENDITURES ON A 100-MILLION-DOLLAR HIGHWAY CONSTRUCTION PROGRAM

Hence, a continuing highway construction program is an important economic stabilizer and also provides much-needed transportation facilities. This program has lagged ever since the collapse of the early thirties, and this accumulating deficit has been aggravated by almost complete absence of new construction during the war. This program will (1) provide a system of modern highways, (2) act as an economic stabilizer, (3) eliminate the possibility of made work, and (4) assure a permanently stable economy.

Construction dollars have an enormous leverage effect on the nation's welfare. During the prosperous twenties, private and public construction expenditures ran well over ten billion dollars annually for much of the period. The period was one of extensive road building, and also of expansion of all the related industries including steel, road machinery, cement, asphalt, tar, and other materials. Bond financing by state and local governments for highways, schools, and other public improvements amounted to more than a billion dollars a year during the twenties, and largely because of the construction of a new network of highways, there was an unprecedented growth in automobile registrations, amounting to 2,000,000 vehicles a year.

The partial recovery of the thirties compared favorably in some respects with the prosperous twenties. The national income increased, there were comparable expenditures on plant and equipment, but there was large unemployment until labor was absorbed by the war. The unfilled gap was construction. In this classification, expenditures were substantially lower than in the prosperous years; residential building lagged, as did highway and other public construction, also railroads and public utilities. The 9,500,000 unemployed in 1939 can be traced directly to the lack of construction expenditures (Fig. 2). Obviously construction cannot be allowed to fluctuate between wide limits without causing mass unemployment and depressed conditions. This country must not stop building. Prosperity can exist only as long as there is a large volume of industrial, residential, and public works construction.

HIGHWAY PROGRAM CALLS FOR ELIMINATION OF INTERSECTIONS AT GRADE AND GREATER WIDTH ON MANY CONGESTED MILES OF NATION'S PRIMARY SYSTEM

Obviously also, there should have been no need for made work in the thirties inasmuch as there was plenty of needed work had it been ready. If it had been ready there would have been no necessity for relief agencies to take over, causing the substitution of day-labor methods for competitive bidding. The $4,000,000,000 spent on highways by relief agencies could have been contracted had the work been ready, thus resulting in considerable saving by the more efficient operation of free enterprise. The best insurance against a repetition of the depression experience is an accumulation of projects ready for letting at all times. If needed projects are ready, there can be no legitimate excuse for made work.

During the war years, the highway program included merely the construction of access and other necessary roads, principally for the war effort. In 1945, the program amounted to only 325 million dollars. It is hoped that the highway program for 1946 will approximate 750 million dollars, although current estimates are somewhat lower than this. The program should increase until, by the year 1949, the amount of new construction placed under contract is at least two billion dollars. From then on, in order to furnish adequate transportation facilities for this country, the highway program for many years should range from two billion to three billion dollars a year (Fig. 3).

People not familiar with the part that the highway program plays in the national economy, and in daily lives, are talking of small investments in highways and asking where the money is coming from. In the last years before the war the highway user paid into the government agencies in highway-user taxes approximately $2,240,000,000 a year. With the additional ten or fifteen million new cars coming on the highways and with the pent-up desire of everyone to get out on the road again, the gasoline taxes collected by the state and federal governments would amply finance the cost of all new highway construction if it were all used for that purpose. In some states, no doubt, the direct tax will not be sufficient. In these states possibly bond issues will be resorted to, based on highway-user income. As the highway investments increase so will the tax returns from the highway user, and in this way the highway-user taxes will tend to keep highway financing at an adequate level.

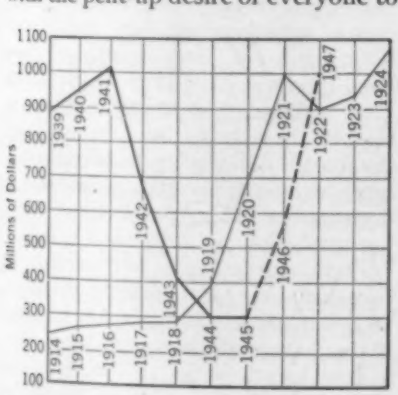


FIG. 3. VOLUME OF HIGHWAY CONSTRUCTION DURING TWO WARS, WITH FORECAST OF COMING YEAR'S TREND

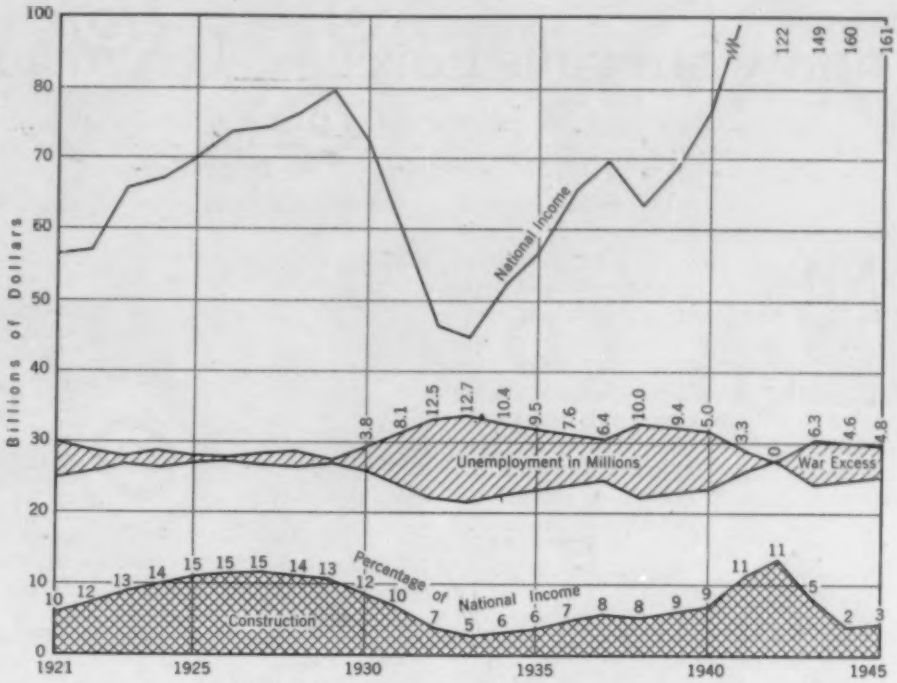


FIG. 2. RELATIONSHIP BETWEEN CONSTRUCTION, NATIONAL INCOME, AND EMPLOYMENT

In the 1944 Highway Act, Congress provided 500 million dollars a year for three years and this must be matched—making a total of a billion a year for three years. In addition there will be a sizable program carried on by states, counties, and cities, in which federal aid will not be used—thus increasing the program. All levels of government are now in a better financial position than they were before the war.

The Federal-Aid Act of 1944 provides for annual appropriations of $225,000,000 for the rural and urban federal-aid system of primary highways. This is larger than any former program and in addition it provides $150,000,000 for the construction of secondary roads and $125,000,000 for the construction of federal-aid highways in urban areas. This work is being arranged for through the state highway departments, and one of the necessary factors essential for the success of the program is sympathetic cooperation between states and counties and between states and cities. Unless this exists, the total program will be delayed. The Act provides for a balanced highway program which, if successfully accomplished, will provide highway transportation facilities far in advance of anything the country has ever known.

Within the calendar year 1946, federal aid and matching funds available amount to $2,212,000,000, made up as follows:

Unobligated federal funds	$ 106,000,000
State matching funds	106,000,000
Federal aid, 1945–1946	500,000,000
State matching funds	500,000,000
Federal aid, 1946–1947	500,000,000
State matching funds	500,000,000
	$2,212,000,000

If this program is not carried out the states will be penalized in that the facilities will not be provided. Between the years 1916 and 1933 federal-aid monies constituted only 6% of the total financing of state highways. For a brief period later the federal contributions were approximately 30% of all funds expended in highway construction. From now on, not only will the federal portion of state investments increase to a point nearer 50% of the total, but there will be greater participation by the Federal Government as it will assist in construction of primary, secondary, urban, and interstate highways.

Snow Surveys Forecast Irrigation Water Supply

Taken from Paper Presented at Joint Session of Irrigation and Power Divisions in Spokane

By R. A. Work

Irrigation Engineer, U.S. Soil Conservation Service, Medford, Ore.

MORE than 80% of the water for irrigation in eleven Mountain and Pacific Coast states originates in the snow fields on mountain watersheds. With spring thaws, the water is released and flows down to irrigate farm lands and serve other beneficial uses. In Utah, for instance, only 20% of the state's area is above 7,000 ft in elevation, yet this 20% contributes from 70 to 80% of the total runoff. This situation makes practical the accurate forecasting of stream flow from measurements of accumulated snow.

Modern Over-Snow Vehicle Used for Snow Surveying

Snow surveys determine the amount of water stored in the accumulated mountain snow cover. Although the basic purpose is to forecast water supplies for irrigation use, nevertheless the data are so broad as to permit the forecasting of supplies for other uses. Snow surveyors are now providing runoff forecasts useful to power companies; to municipalities and municipal water supply districts; to levee, drainage, and flood control districts; to navigation companies; to mining and lumbering interests; to industrial concerns; to engineers and constructors of water control works; and to others concerned with planning or administering water resources. The Division of Irrigation of the Soil Conservation Service is the coordinating agency for these surveys.

Nearly 1,000 men from 170 cooperating agencies were employed in the work during the past winter. They conducted nearly 2,300 separate surveys on 925 snow courses in 12 states and 2 Western Canadian provinces. They used 185 shelter cabins scattered along 20,000 miles of winter ski trails in accomplishing this job. These skilled snow surveyors have been found in the ranks of agencies such as the Forest Service, National Park Service, Geological Survey, Fish and Wildlife Service, Bureau of Reclamation, and Indian Service; state watermasters; and others.

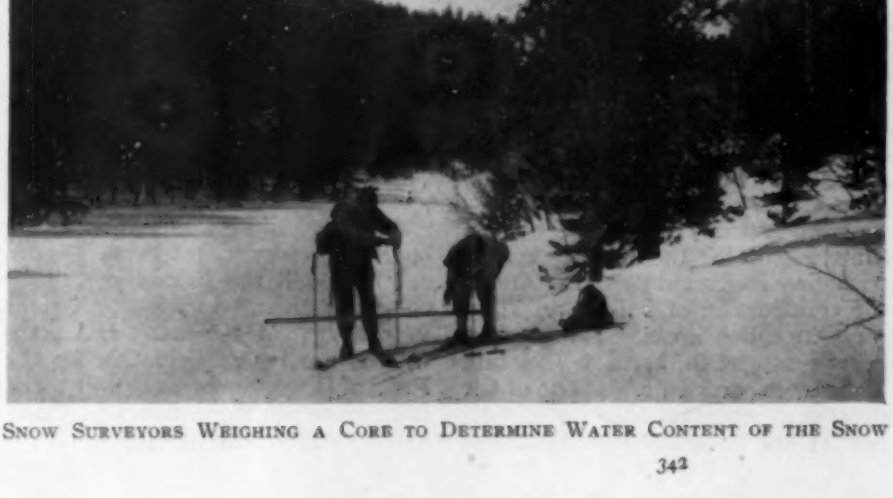
TIMING OF SURVEYS

All snow courses are measured on about April 1, but many courses are measured at regular monthly intervals throughout the winter. Early winter measurements often are significant indicators in years of reduced runoff or in years of overly abundant stream flow. Reports of these surveys are issued by months through the winter season. Additional data on watershed and crop-land soil moisture, antecedent stream flow, reservoir storage, and valley precipitation, are also given. The issues of April 1 and May 1 of each year contain final water supply forecasts for the season. These processed reports are available by states or by drainage basins for the following areas: Arizona, British Columbia, California, Montana, Nevada, Oregon, Colorado River Basin, Columbia River Basin, Missouri and Arkansas River basins, and Rio Grande River Basin.

Speed, accuracy, and practicality are essential to useful water supply forecasting. Field and office methods have been developed which furnish water users with preliminary or final water supply forecasts as quickly as 4 or 5 days after completion of the distant mountain snow surveys. To insure useful forecasts, snow survey leaders constantly keep contact with groups of water users to determine their needs for specific forecasting.

Successful use of snow surveys in forecasting runoff is due to the fact that most of the snow falling at high elevations occurs in a few major storms which usually are uniform in intensity over large areas. It has been demonstrated that accumulated snow measured at a few locations is related directly to later runoff from the basin. A few snow courses in a large drainage basin thus provide a dependable index to the winter snow accumulation at high elevations.

Snow surveys do not necessarily measure the total volume of water stored in a basin as snow, but measure instead the water accumulated at only a few locations in the basin. The index relationship may be shown by plotting on the axis of ordinates the water content of the snow at peak



Snow Surveyors Weighing a Core to Determine Water Content of the Snow

accumulation (usually April 1), and plotting on the axis of abscissas the corresponding resulting runoff. A smooth curve, often nearly a straight line, may then be fitted to the seasonal plottings and used to forecast the runoff in following years. A series of at least 10 plottings is usually desirable to define the forecast curve. At least 10 years of record are now available on 80% of the Western snow courses.

The method of determining the amount of water stored in the mountain snow cover is accurate, rapid, and elementary. A slotted duraluminum sampler tube, having a circular saw-edged cutting point, is thrust vertically down from the snow surface to the soil beneath. The inner diameter of the sampler's cutting point is 1.485 in. A column of water of this diameter at 32 F weighs one ounce per inch of depth. Water content of snow is determined by weighing snow cores of this diameter as cut by the sampler. After the sampler is withdrawn, the tube and its contained snow core are weighed on a spring scale calibrated in ounces. The difference between the full and the empty weight of the sampler, both in ounces, directly equals the water content of the snow in inches.

Measurements of snow of great depth are secured by coupling together many 30-in. sections of the light-weight tubing. Using one such sampler, snow 305 in. deep was sampled for water content on April 1, 1946, on the Loch Lomond snow course near the City of Vancouver, B.C.

COURSES CAREFULLY LOCATED

Locations at which the mountain snow is sampled for water content are called snow "courses." Courses are located wherever possible in sheltered meadows not subject to excessive deposition or loss of snow by reason of high wind velocities or by unsuitable exposure. A course usually includes one or more tangents along which equally spaced samples are taken at exactly the same locations season after season. To insure this precision, courses are mapped and key points are distinctively marked. Eventually, it is planned that most courses will be clearly and permanently defined by steel pipes set in concrete. This has been accomplished in Utah, in Oregon, and in parts of Nevada, Idaho, and California. Determinations sufficient in number to reveal accurately the average water content of the snow are made during each survey on every course.

Snow courses at high elevations are better indicators of the accumulated winter snow cover than courses at low elevations, since little winter melting occurs at high levels. Snow courses at intermediate or low elevations are used to confirm the usual presence or absence of snow cover at those levels, thus providing correction factors to the data from high elevations. Snow courses at low elevations are particularly useful as indicators of potential flood hazard in years of unusually plentiful snow accumulation on such courses.

A Typical Snow-Course Location in a Sheltered Mountain Meadow at High Elevation

To make snow surveys more useful, especially in connection with the forecasting of flood discharge of snow-fed streams, snow surveys should be initiated earlier in the winter and continued later into the spring than is now the practice. On at least some courses, measurements at more frequent intervals than once a month should be made. There is also need for developing runoff forecasts useful to individual farmers on upstream tributaries and for refining the methods used to forecast water supplies for larger groups of water users in main-valley agricultural or industrial areas. To accomplish these aims, snow-survey leaders need to become fully acquainted with the water supply problems of their areas in order to better adapt existing data or secure the most useful data to help solve specific problems. In addition to this work, an important objective is wider and more complete distribution of the water supply forecasts. Likewise, means of better acquainting water users with the purposes and services of snow survey work are desirable.

Better facilities for accomplishing field work are needed. These include more snow survey equipment, cabins, and mechanized snow transport. With these improvements, to insure maximum return for each tax dollar expended in snow surveys, it will be necessary to avoid duplication in field work. For this purpose a policy has been developed within the snow survey group itself as well as within the Department of Agriculture, preventing the issuance of duplicating or conflicting forecasts. It is important that all these objectives be realized, for with accelerated industrial and agricultural development in the Mountain and Pacific Coast States, the available water supply is being used to its limit. Every means for economic use of all available water must be utilized.

A Snow-Buried Shelter Cabin Looks Good to Snow Surveyors at the Day's End

Lessons in Bridge Design Taught by Aerodynamic Studies

Tacoma Bridge Investigations Indicate Instability of Stiffening Girders for Suspended Spans

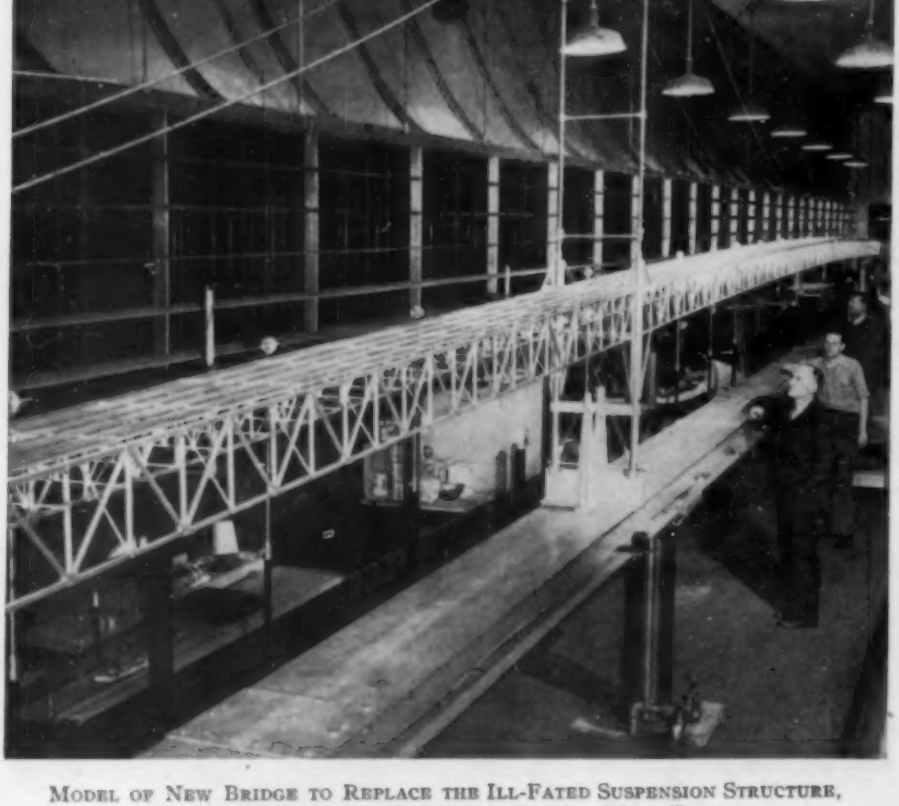
By F. B. Farquharson, M. ASCE

Professor of Civil Engineering and Director of Engineering Experiment Station, University of Washington, Seattle, Wash.

THE dramatic collapse of the Tacoma Narrows Bridge exposed the inadequacy of the conventional method of designing against wind action and inaugurated a new era in which the dynamics of wind action was forced upon the attention of the civil engineer and the suspension bridge was jolted into its true classification as a dynamic structure. The insufficiency of the conventional 30 lb as a criterion for wind design was revealed by this evidence that a horizontal wind was capable of creating appreciable motions in a vertical direction under the action of wind forces amounting to only a small fraction of the 30-lb per sq ft lateral pressure for which the structure was designed. It should be recalled that the original Tacoma Bridge developed uncomfortable vertical motions in wind velocities as low as 7 or 8 miles per hr.

A LONG-span bridge must be considered as a dynamic rather than a static structure. The complete inadequacy of the conventional design criterion as regards wind loading was forcibly presented by the collapse of the Tacoma Narrows Bridge. Investigations of the bridge's behavior before its collapse and subsequent aerodynamic studies of models in a specially constructed wind tunnel provide new rules for the bridge designer. This summary of lessons learned was presented to the Structural Division at Spokane.

The redesign of the Tacoma Narrows Bridge has marked the first attempt to reduce the exciting forces of the wind on a suspension bridge through the modification of the shape of the suspended structure. The major tools used in this study were a specially designed wind tunnel capable of accommodating a 1:50 scale model of a 5,000-ft bridge and a series of section models built to the same scale. The maximum wind velocity available was the equivalent of 118 miles per hr on the prototype. The greater part of the search for an aerodynamically stable section was carried out on section models, but the behavior of several of the most promising sections was confirmed on the full model.



Model of New Bridge to Replace the Ill-Fated Suspension Structure, Under Study by the Author in Special Wind Tunnel

Conclusions Reached

As a result of considerable research at the University of Washington by the Washington Toll Bridge Authority, with the cooperation of the Public Roads Administration, involving section models of girder-type bridges of various proportions and truss-type bridges of the top-deck type with numerous arrangements of deck and sidewalk, one may venture the following categorical statements:

1. Girder-type sections were always aerodynamically unstable, with the maximum excitation occurring in a horizontal wind.

2. Truss-type sections were always at their best in a horizontal wind, with most of them showing a critical velocity in excess of 100 miles per hr at zero angle of attack. The majority of this type of section required angles of attack of several degrees of upward acting wind to bring the critical wind velocity below 100 miles per hr. In general, this type of section was stable under all downward-acting winds.

3. Girder-stiffened sections always developed both vertical and torsional motions.

4. Vertical motion has never been isolated on truss-type sections, but evidence is at hand that on some sections this type of motion might be developed at a high angle of attack.

5. On girder-type sections all vertical motions were non-catastrophic unless the ratio of girder depth to width of bridge (d/b) exceeded a certain value. The exact value of this

limiting d/b ratio has not yet been precisely determined, but it appears to be slightly above the value of $d/b = 0.2$ used on the original Tacoma Bridge.

6. Torsional motion on girder-type sections was always catastrophic.

7. Torsional motion on truss-type sections of orthodox form was always catastrophic.

8. In general, excitation on girder-type sections was much stronger than on truss-type sections. That is, the time required for a torsional motion of catastrophic proportions to develop was much shorter with the girder type than with the truss type. It is believed that the principal source of excitation is different in these two cases.

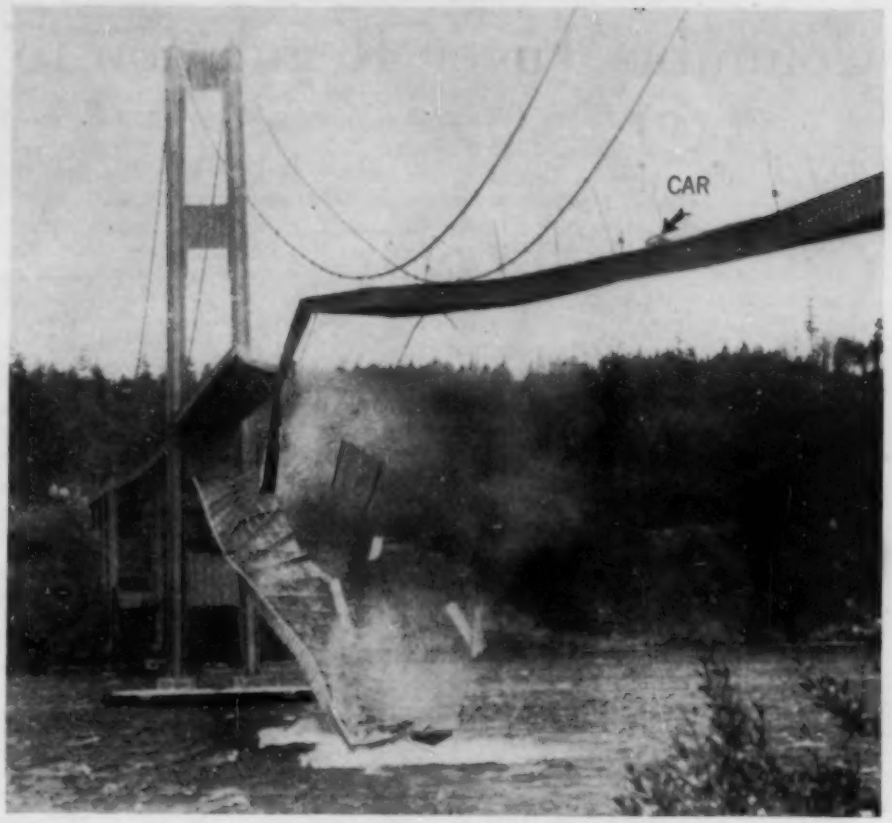
9. Under the action of a perfectly steady wind (steady in velocity and direction) at some angle of attack above the critical angle, all sections of any shape showed a torsional motion which was controlled and modified by the overall stiffness of the bridge (i.e., the natural frequency in the dominant mode).

10. No sectiond eveloping catastrophic torsional motion was appreciably affected by an increase in damping within the practical range. Sections showing non-catastrophic torsional response were very sensitive to a change in damping. In some cases damping within the assumed practical range reduced the maximum amplitude in torsion to very nearly the vanishing point.

11. The probable range of damping naturally inherent in any conventional suspension bridge is not large enough to affect the critical wind velocity appreciably, but may be sufficient to restrict materially the maximum amplitude of a non-catastrophic motion.

12. It appears that the chief factors controlling the critical velocity in torsion are the natural frequency of the structure in the dominant torsional mode and the shape of the suspended structure. The geometry of the total structure (i.e., the sag, side spans, and truss) is the principal factor controlling the torsional frequency, which in any given case is not open to much manipulation except through the use of both top and bottom lateral systems.

13. Laboratory research has indicated the possibility of designing sections which possess non-catastrophic response characteristics in torsion and which will show little or no motion under the influence of damping of the order which may be expected with conventional design procedure. It appears that these characteristics will only be obtained on the truss type of section and that they will show no evidence of vertical motion or coupling.



"GALLOPING GERTIE" GIVES UP
Collapse of the Tacoma Narrows Bridge on November 7, 1940

14. It appears probable that any practical form of open-deck design is of little value in stabilizing girder-type sections. Indeed some arrangements of open deck are definitely detrimental.

15. On truss-type sections, it appears that a full open deck will provide complete stability under all conditions. There are some practical disadvantages, however, in this type of construction.

16. The slotted type of deck used in the new Tacoma design develops motion over only a limited range of wind velocity and over only a narrow range of angles of attack. Furthermore, the motion which is a non-catastrophic torsion is restricted to small amplitudes even under very low damping conditions.

17. The components of a truss-type section which control its aerodynamic properties are all located in the vicinity of the deck level. That is, portions of the stiffening structure other than the top chord appear to have little or no effect on the aerodynamic stability of the section.

18. No vertical motion has been isolated on any truss-type section yet tested but evidence of the presence of vertical motion has been noted in some cases. There have been many indications of the coupling of vertical and torsional modes in the case of truss-type sections, and it seems that some degree of coupling is often present in this type of bridge when a solid deck is used.

19. Any irregularity in the direction of the wind, especially with respect to the vertical angle, develops strong damping effects, thus accounting for the fact that many bridges which will show unstable characteristics in the wind tunnel show little or no motion in the field. It is a fortunate fact that natural wind in most locations shows marked irregularities in both direction and velocity due to the effect of the surrounding terrain.

It should be emphasized that the chief purpose of the investigation for which the results have just been presented in summary was the design of an aerodynamically satisfactory section for a specific suspension bridge. The conclusions set forth here should be taken as tentative with respect to any other design until confirmed by further specific tests. The field of aerodynamic investigation of suspension bridges has been too little explored as yet to permit any dogmatism regarding the ultimate in the shape of the suspended structure.

Columbia River Regulation to Aid Navigation

Taken from Paper Presented Before the Waterways Division at the Spokane Convention

By R. E. HICKSON, M. ASCE

CHIEF OF ENGINEERING DIVISION, U.S. ARMY ENGINEERS, PORTLAND, ORE.

CONSTRUCTION of additional dams on the Columbia River, as now authorized and proposed (Figs. 1 and 2), will greatly facilitate the movement of river traffic. Present plans call for the construction of three, or possibly four, dams on the river between The Dalles and the mouth of the Snake, and a series of dams to provide slack water on the Snake River below Lewiston. Of the Columbia dams, the one at Umatilla Rapids, known as McNary Dam, has been authorized by Congress, as have the dams for the Snake River.

McNary Dam will be about 7,400 ft in length, and will have a normal (low-water) head of 89 ft. It will be a concrete structure very like Bonneville, with earth-fill construction on both ends. The spillway will be controlled by 24 vertical-lift gates with a total flood capacity of 2,200,000 cu ft per sec. Fourteen power units will be provided for initially, and space and substructures for 6 additional units for future demand. The fourteen units will have an installed capacity of 966,000 kw.

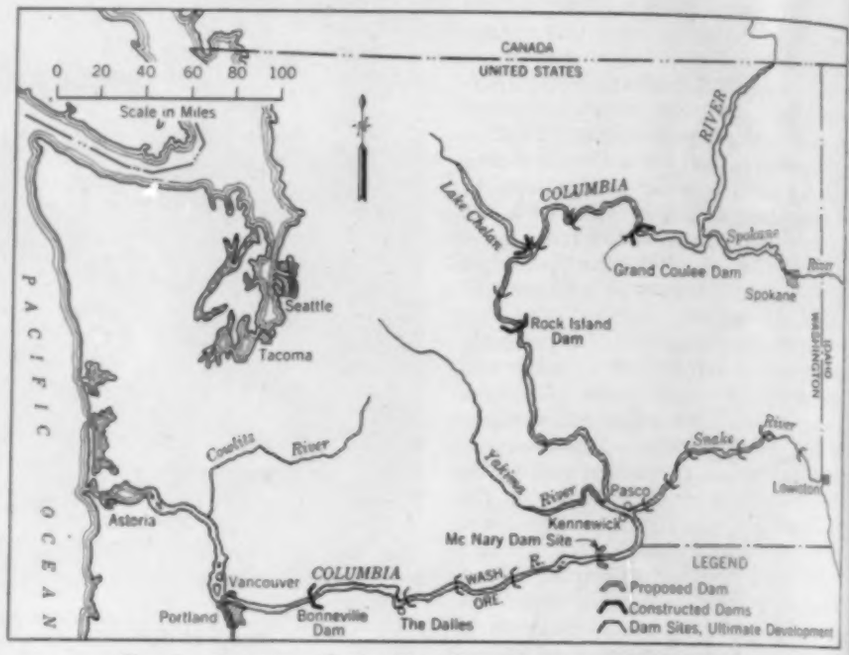


FIG. 1. COLUMBIA RIVER DAM SITES SELECTED AND PROPOSED

LOCKS PASS BARGES

The lock planned for this dam will be 86 ft wide and 500 ft in length, with a single lift of 89 ft. Depth on the sill will be 14 ft at low-water stages. This lock will pass four large barges and a tug in a single tow. Ample guide walls and mooring facilities will be provided both upstream and downstream. The lift here to be provided will be higher than any lock yet constructed, and with the 86-ft lock width will require very careful investigation and design for the gates. McNary Dam will adequately provide for navigation over Umatilla Rapids, where the river now drops 17 ft in about $2\frac{1}{2}$ miles, and also over Homly Rapids above the mouth of the Snake River.

In the 102 miles of river between The Dalles and Umatilla, two or three additional dams will be required. The first of these now under definite consideration will be located at the head of the Bonneville pool. It will be known as The Dalles Dam, and will create a head of 87 ft at normal pool levels. It will drown out the existing but now inadequate Dalles-Celilo Canal and locks.

OIL BARGE IN MIDDLE JOHN DAY RAPIDS, UPPER COLUMBIA RIVER

UNUSUAL METHODS REQUIRED

At The Dalles Dam, the main river closure will be in a narrow defile with a maximum low-water depth of about 170 ft. River currents are on the order of 6 to 10 ft per sec during normal flood stages, so that an unusual design and unusual methods of construction will be required. Preliminary plans call for a stone fill, graded in zones from the heaviest available in the downstream zones to

the final sealing materials on the upstream face. The distance through this stone-fill dam from upstream to downstream toe will be about 1,500 ft. The use of cofferdams is not contemplated. The spillway, power house, and lock can largely be constructed in the dry, as they will stand on a broad rock ledge which is above normal river stages.

The lock will be of the same dimensions as that at McNary Dam and will have about the same lift. The spillway for these dams, like all others on the Columbia below the Snake River, will be gate-controlled in order to provide capacity to pass the tremendous flood flows without unduly increasing the pool levels. Sites for the additional dams between The Dalles and Umatilla have not yet been definitely selected, as the location will depend to a large extent upon the final design and the determination of pool level for The Dalles Dam, and the exploration of possible sites. There is a possibility that one dam may be sufficient in this reach.

SERIES OF DAMS ON SNAKE RIVER

For the Snake River below Lewiston (140 miles of river), Congress has authorized construction of a series of dams to provide primarily for slack-water navigation. Field investigations are under way to determine satisfactory sites, and the number of dams—four, five, or six—which will most satisfactorily and economically meet the situation. Snake River Canyon is relatively narrow and at some sites the problem of finding sufficient space for lock, spillway, and power plant is involved. An investigation and study are under way to determine the possibility of using the "suppressor" type of power house and draft tube, wherein the power units are constructed in the pool a short distance above the spillway, and draft tubes pass under the spillway and discharge at the downstream edge of the ogee section and upstream from the hydraulic jump. All plans are still in the preliminary stages. Locks for Snake River dams probably will be 86 ft wide and at least 360 ft in length. The total fall in the river below Lewiston is 375 ft and, with six dams, the lifts will vary from 50 to about 75 ft. For a four-dam series, the maximum lift would be about 110 ft. All locks will probably be the single-lift type and will accommodate multiple tows of about 9-ft draft.

The dimensions of locks planned for the Columbia above The Dalles will have a margin of capacity of at least 3 to 1 over this estimated future movement. Plans will provide space, however, for the installation of an additional parallel lock should the need for one arise at some time in the future.

Tonnage moved on the Upper Columbia has increased about 38,000 tons per annum at the time Bonneville Dam was completed, to a present total of 612,000 as far as The Dalles, and about 543,000 tons above that point. Bonneville Dam and lock on the Columbia, 140 miles from the sea, served to drown out Cascade Rapids and about three miles of river formerly very difficult for navigation. This dam, completed in 1938, provides slack water to a point above The Dalles. The greater part of the tonnage in recent years has been in petroleum products upstream, but navigation companies are now building new barges and equipping their existing barges for return cargoes of wheat and other products. The estimated movement at the end of fifty years is $5^1/_2$ million tons, a considerable part of which will come out of the Snake River.

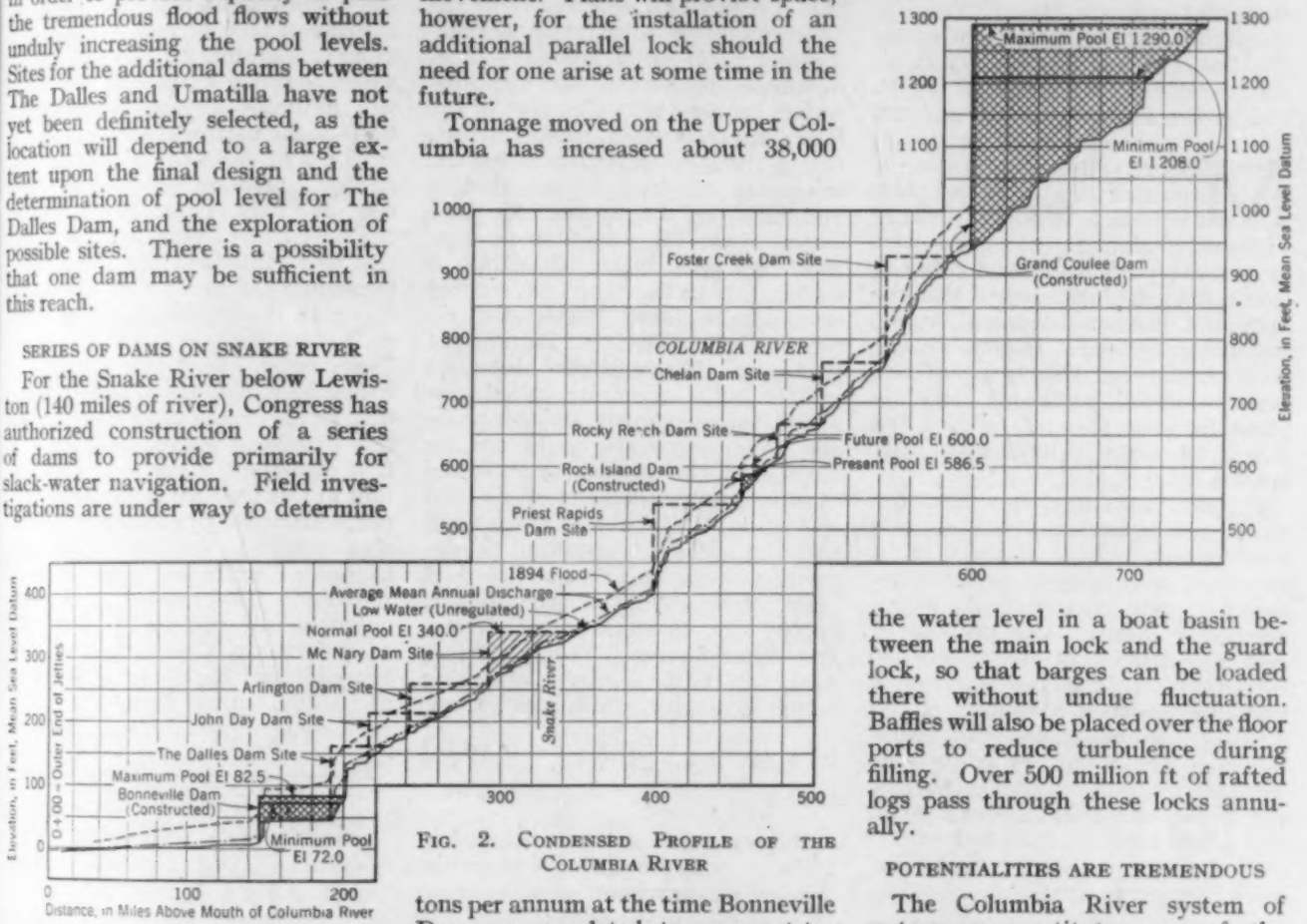


FIG. 2. CONDENSED PROFILE OF THE COLUMBIA RIVER

NEW LOCKS ON THE WILLAMETTE

For the Willamette River, the principal tributary of the Columbia west of the Cascades, new locks are planned to replace the existing flight of four small locks at Willamette Falls. The new structure will provide for a single lift of $49^1/_2$ ft in a lock 56 by 400 ft in plan, with a $9^1/_2$-ft depth over the sills. The only unusual feature in these locks will be a large syphon spillway to regulate the water level in a boat basin between the main lock and the guard lock, so that barges can be loaded there without undue fluctuation. Baffles will also be placed over the floor ports to reduce turbulence during filling. Over 500 million ft of rafted logs pass through these locks annually.

POTENTIALITIES ARE TREMENDOUS

The Columbia River system of waterways constitutes one of the greatest assets of the Northwest. The region through which the rivers flow is as yet largely undeveloped, but the potentialities of the region for the development of great quantities of electric energy are tremendous, and will within a short time result in a great industrial development and increased commerce. Transportation is one of the principal factors in all developments, and water transportation is the lowest in cost of any yet devised. Improvement of the Columbia and its tributaries for navigation is accordingly one of the most vital factors affecting the region and its people.

Polluted Streams Cleared Up by Aeration

By RICHARD G. TYLER, M. ASCE
PROFESSOR OF SANITARY ENGINEERING, UNIVERSITY OF WASHINGTON, SEATTLE, WASH.

MORE efficient in purifying wastes than artificial treatment methods are Nature's own disposal plants, the rivers. However, the process is too slow and the capacity too limited to eliminate the pollution of streams grossly overladen with wastes. One form of assistance the engineer can give is to aerate the oxygen-depleted waters of the loaded stream. The economy of this practice is striking—in some cases. Measures of effective practice were given at the Spokane session of the Sanitary Engineering Division by Professor Tyler. This article is taken from his address.

MANY streams receive a greater load of organic matter than they can oxidize without depleting their dissolved oxygen to a point below that required to support fish life or prevent the production of noxious odors and an unsightly appearance. Heretofore the only remedy for this situation has been to install additional disposal-plant facilities so as to reduce the B.O.D. loading placed upon the stream.

Several years ago, however, the writer recommended as an alternative remedy the reaeration of a stream so as to bring its depleted dissolved-oxygen content back to an acceptable value. The purpose of such aeration is not to produce direct oxidation of the offending organic matter since such a process is too slow for practical application. Aeration may shake out certain volatile substances affecting the B.O.D. of the stream and thus remove a small part of the involved load, but its primary function is to increase the dissolved oxygen to a satisfactory value.

SELF-PURIFICATION OF STREAM

Artificial aeration of streams has been termed "accelerated reaeration" by the writer as descriptive of the process which takes place. The stream itself has provided the organisms, dissolved oxygen, and time interval required for the oxidation of its organic content or pollutional matter. In other words, the stream is acting as a disposal plant from the point at which the sewage enters to that where "accelerated reaeration" is applied. The stream is efficient in this process of self-purification. The required microorganisms are always present, being washed from the soil of the drainage area into the stream. The replenishment of dissolved oxygen at appropriate points along the watercourse would raise the dissolved oxygen sufficiently above the minimum requirements so that this action of self-purification could continue.

The economics of this process, therefore, depend upon the relative cost of removing 1 lb of B.O.D. by the construction of a standard sewage-disposal plant or of adding 1 lb of dissolved oxygen to the receiving waters by aeration. The cost of the latter depends upon many factors, one of the most important being the minimum dissolved oxygen that is permissible in the stream. In those states where the minimum requirement is 3 ppm, higher efficiencies of oxygen absorption can be secured economically from "accelerated reaeration" than in areas requiring 4 to 5 ppm. The efficiency decreases rapidly with increasing initial dissolved-oxygen content, and it is probable that economies could not be secured by this process at an initial dissolved-oxygen content of about 5 or 6 ppm. The dissolved oxygen will vary for different installations, depending on the unit cost and method of furnishing and distributing the air, bubble size, temperature of stream, and other factors. This matter is further clarified by observing Adeney's formula, which is as follows:

$$W = (w_s - w_i)\left[1 - e^{-0.01\,(T-36)\,\frac{A}{V}t}\right]$$

in which

W = increase in concentration of oxygen at end of t minutes
w_s = concentration of oxygen at saturation
T = temperature in degrees C
w_i = initial concentration of oxygen
e = base of common log = 2.718
A = area of contact surface in square centimeters
V = volume of water in cubic centimeters

From this formula, it is obvious that the quantity in the brackets represents an aeration coefficient that would be constant for any particular reaeration installation. The increase in concentration, therefore, varies directly with the initial dissolved-oxygen deficiency, $(w_s - w_i)$. Figure 1 gives a graphical presentation of the formula for various temperatures and saturation deficiencies for the condition where the ratio A/V = 20, which obtains when one volume of water is aerated with one volume of air, if the latter is supplied in bubbles of 0.3 cm in diameter. From this figure, it is observed that the efficiency decreases very rapidly as the oxygen deficiency decreases, and the time of aeration required increases at an accelerating rate. The point at which aeration becomes impractical will naturally depend upon conditions at the particular installation.

The first full-scale experiment in stream reaeration has been in progress at Park Falls, Wis., during the past three summers. The aeration unit consists of 319 sq ft of carborundum diffusers set at a depth of about 10 ft and supplied with 1,550 cu ft of air per min at a pressure of 5 lb per sq in. With this installation, it has been possible to add approximately 1.5 tons of oxygen per day to the Flambeau River, which has a flow of 880 cu ft per sec. In addition to this increase in dissolved oxygen, satisfaction of part of the B.O.D. also resulted, causing a marked movement upstream of the zone of recovery. The research was originated jointly by the Sulfite Pulp Manufacturers' Committee on Water Disposal and the State Department of Health, both of Wisconsin, and is proceeding under the supervision of

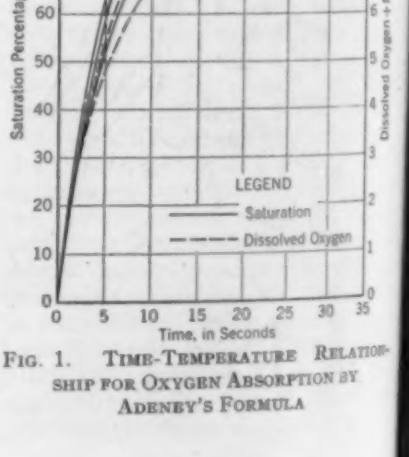


FIG. 1. TIME-TEMPERATURE RELATIONSHIP FOR OXYGEN ABSORPTION BY ADENEY'S FORMULA

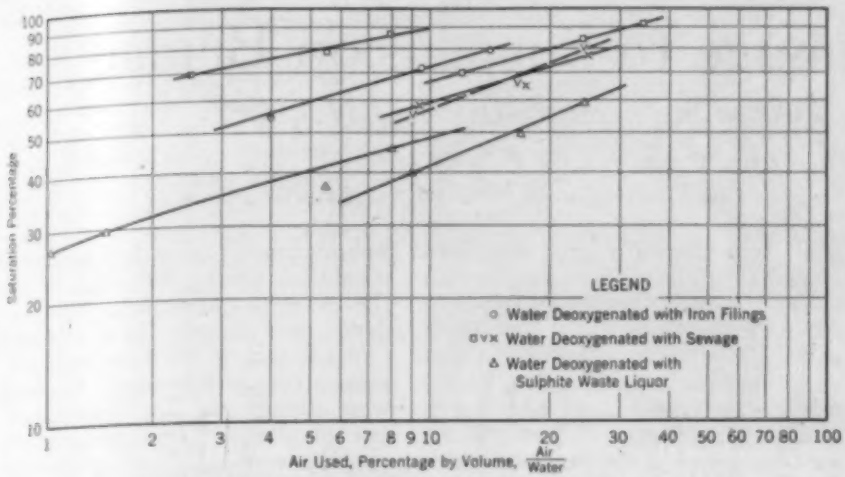


FIG. 2. RELATIONSHIP OF QUANTITY OF AIR USED TO INCREASE SATURATION IN A 4-FT DEPTH

the National Council for Stream Improvement.

Improvements in the stream at resorts located some 25 to 30 miles downstream were encouraging and a dissolved oxygen content at, or above, 3 ppm was maintained during the 1945 season at a location some 18 miles below the point where the sulfite waste liquor (SWL) enters the stream. A reaeration efficiency in excess of 5% of absorbed oxygen was being obtained at relatively low installation and operational costs.

LABORATORY TESTS

Our experiments in the laboratory indicate that a C.O.D. (chemical oxygen demand) is produced by free and loosely combined SO_2 and perhaps other volatile acids present in the SWL. Steam stripping, which removes all of the free and about half of the loosely combined SO_2, should therefore remove most of the C.O.D. Our laboratory experiments, however, indicate that only about 20% of the C.O.D. is thus removed. If the other volatile acids present have also been removed by the steam stripping process, it is obvious that further research is necessary to evaluate the origin and amount of C.O.D. produced by SWL when discharged into a stream. This research is at present in progress in the Sanitary Laboratory, University of Washington.

Air applied during the reaeration of a stream receiving SWL, as in the Park Falls installation, undoubtedly has an effect upon these three factors—the dissolved oxygen, the C.O.D., and the B.O.D. Laboratory experiments indicate that where aeration occurs shortly after the liquor enters the stream, little if any effect on the dissolved oxygen is observed. In fact, an actual decrease in dissolved oxygen has frequently occurred. If the same aeration is applied 24 hours after the addition of the liquor to the water, satisfactory oxygen-absorption efficiencies are obtained. The present research has a bearing upon the immediate problem in that where strong trade wastes are involved, having appreciable C.O.D.'s, it indicates that it may be better to allow ample time for as complete an adjustment of these factors as possible by the stream before applying artificial reaeration.

In this connection, the results of an earlier series of tests made by the writer are of interest in showing that the efficiency of aeration varies with the character of the pollutional load on the stream. Figure 2 gives a summary of these tests and shows the difference in efficiency of oxygen absorption for water deoxygenated in three different ways. The two lowest curves represent the results obtained in the reaeration of water deoxygenated with SWL. Four of the remaining curves give the results of reaerating sewage-polluted waters, while one gives similar data for water deoxygenated with iron filings.

There are a number of situations where stream reaeration may be used to better advantage than standard methods of eliminating the offending pollutional matter. The method is, as yet, only in the experimental stage but where the economies to be obtained are appreciable, further large-scale experimentation may be initiated with a fair assurance of securing satisfactory results. Some of the situations in which accelerated reaeration should prove advantageous are the following:

1. To rehabilitate streams where pollution has greatly reduced the dissolved oxygen.
2. To take care of overloads of pollution where existing disposal-plant capacity is being overtaxed.
3. To avoid expensive disposal-plant expansion for protecting a stream from increasing B.O.D. loadings.
4. As a method of secondary treatment.
5. For joint use by several communities whose disposal-plant effluents are overloading the receiving stream.

ECONOMIC ADVANTAGES

These applications of reaeration would naturally require economic justification but may also be found advantageous for other miscellaneous reasons such as getting a stream cleaned up more quickly than might be possible where disposal-plant expansion would be otherwise required. It would be especially advantageous in taking care of seasonal loads or summer conditions and thus avoiding the necessity for having a larger plant capacity than would be needed throughout most of the year. The smaller investment cost would entail a lower burden of fixed charges and other overhead, and its operating cost should be similarly low. Aeration requires no period of ripening or building up of bacterial activity as in the case of disposal units that have been idle. Where dissolved-oxygen deficiencies originate from sludge deposits in the stream which may require years to oxidize, even after adequate disposal plants have been installed, reaeration affords the most effective means for counteracting their continuing oxygen demand. In fact, it is the only method that is now available for taking care of such a situation.

Experience indicates that a stream is a more efficient purification plant than artificial methods of treatment now used. It is nature's waste-disposal plant, and in it those microorganisms develop which can best utilize or digest the organic and inorganic wastes reaching the stream. It can be assumed that over the years those organisms which prove most effective in this process will survive. The presence of numerous minerals and symbiotic organisms, which cannot be duplicated practically in the artificial surroundings of the man-made disposal plant, assists in the processes of purification. Thus the natural methods of self-purification of our streams, which have been so important in conserving their waters for the use of mankind, may be reinforced efficiently and economically by stream reaeration.

Aircraft Damage to Suspension Bridge

Suspender Ropes Cut on San Francisco–Oakland Bay Bridge

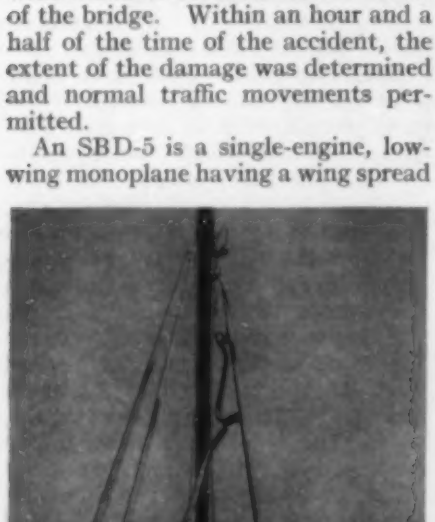
By EDWIN F. LEVY, ASSOC. M. ASCE

ASSOCIATE BRIDGE ENGINEER, SAN FRANCISCO–OAKLAND BAY BRIDGE, SAN FRANCISCO, CALIF.

DAMAGE to the San Francisco–Oakland Bay Bridge resulting from the collision of a Navy aircraft, while involving costly repairs, did not endanger the bridge. Although tragic, the accident did offer engineers an opportunity to study the behavior of a major structure when subjected to such unusual loadings. A careful analysis of the bridge's behavior has been made from the time of the mishap until repairs were completed.

The plane (a U.S. Navy SBD-5) struck the suspender ropes of the bridge on a Sunday morning, September 12, 1942. Truck and rail traffic on the lower deck is at a minimum on Sunday mornings, and gas rationing plus a low fog over much of the Bay area combined to reduce automobile travel on the upper deck. Because of the lack of traffic, it was not possible to obtain eye-witness accounts with which to reconstruct the action of the bridge. Within an hour and a half of the time of the accident, the extent of the damage was determined and normal traffic movements permitted.

An SBD-5 is a single-engine, low-wing monoplane having a wing spread of 41 ft 6 in. and a gross weight of about 7,400 lb. The plane which struck the bridge was flying from the south into or through the low fog at an elevation of about 400 ft. It first struck between the third and fourth sets of suspender ropes (panel points 121S and 122S) west of Tower 5, the westerly tower of the east suspension bridge. From the size and shape of the debris which landed on the upper deck and on the pier fender at the base of the tower, the wings apparently were shorn from the fusilage. The engine and fusilage then plunged ahead with little loss in altitude, striking the third set of suspenders on the north side (panel point 121N) almost head on before falling into the Bay north of the bridge. Except for the parts of the plane that landed on the roadways and on the pier fender, none of the wreckage was recovered.



SEVERED SUSPENDER ROPE—RESULT OF AIRCRAFT ACCIDENT

Examination of the suspender ropes on the south side revealed that only the paint was scratched. The suspender ropes at each panel point consist of two wire ropes $2^1/_4$ in. in diameter, spaced 1 ft 9 in. on centers, looped over the 29-in. main cable. All suspenders at panel points 121S and 122S were marked by the impact.

ROPE SEVERED

The principal damage was to the east suspender of panel point 121N. Six of the seven strands making up the rope were visibly severed and the seventh may have parted some distance from the others within the rope. The adjacent west rope was flattened at the point of impact and a piece of the plane's control or electrical wire driven through it. The actual motion of the suspender could only be estimated. It appeared that a wave or bight was thrown into the rope which traveled down it at least once, forming loops along its length in one or more strands. These loops were 8 to 15 in. in diameter and about 40 ft apart. The wave traveling down the rope also spread the strands so that, upon re-forming, the center strand had changed places with an outside strand.

Except for the flattened spot at the point of impact, and the wire sticking through it, the adjacent west suspender rope appeared not to have sustained much damage; however, there was evidence that it had undergone somewhat similar distortion as had the severed suspender. This evidence was in the form of dents opposite each of the ropes in the 4-in. extra-strong pipe handrail. The dents were about $^1/_2$ in. deep, and the outline of the individual wires of the strands were clearly impressed into the pipe. The suspender ropes are socketed about 11 ft below the top of the pipe rail, and pass through guide castings about one foot under the sidewalk plates. The clear distance between the pipe and the rope is $9^1/_2$ in. As there was no way of definitely determining the amount of damage to the west suspender, it was decided to replace it.

NEW SUSPENDERS INSTALLED

New suspenders, pre-stressed and socketed to the exact length of the original ropes, were installed one at a time by literally pulling down on the main cable until the cable sockets could be slipped into place. This was done by means of a hydraulic jack supported under the lower chord of the stiffening truss on special jacking beams. Short lengths of cables were attached to the ends of the new suspender rope and to the jacking beams. When pressure was put on the jack, it pushed up on the stiffening truss and pulled down on

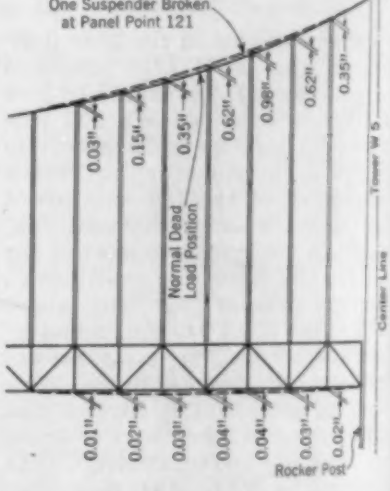


FIG. 1. CALCULATED DEFLECTIONS OF TRUSS AND CABLE CHECKED BY FIELD MEASUREMENTS

the main cable. The jacking equipment was similarly used to release the unsevered suspender.

As has been stated, the damage did not endanger the bridge; however, an unusual accident always brings forth questions as to whether the contingency was foreseen by the designers, or to what extent the safety or capacity of the bridge was reduced, or how much additional damage of a similar nature could be withstood.

No special study was made by the designers of the bridge to determine the effects of suspender-rope removal; however, the load combination used produced a stiffening truss that would distribute the live loads over the length of the main cable. The dead weight of the suspended structure and cables varies from 19,440 to 22,300 lb per ft of bridge in the side spans. The average load for the five panels adjacent to panel point 121N is 10,600 lb per ft of main cable, and 8,500 lb per ft per truss for the suspended structure. The design live load was 8,000 lb per ft of bridge with an unbalanced live load of 6,000 lb per ft.

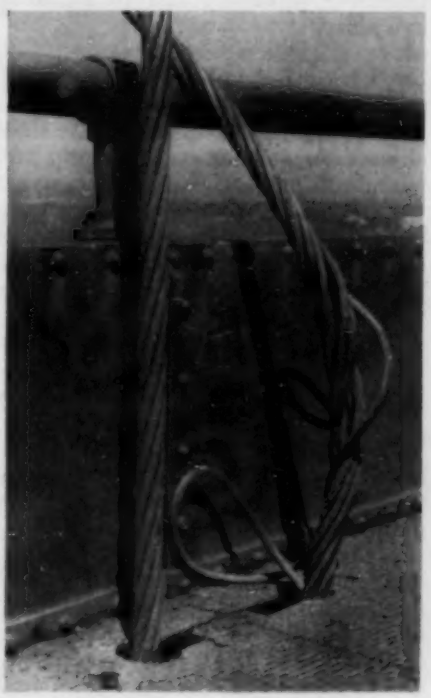
STRENGTH OF ROPES

The $2^1/_4$-in. suspender ropes consist of six 19-wire strands and an independent wire-rope center of seven 7-wire strands. These suspender ropes were specified to have a strength of 400,000 lb under a direct pull, and 380,000 lb when passed around a 30-in. diameter sheave. The ropes were pre-stressed to 200,000 lb (sufficient to raise the modulus of elasticity to 20,000,000 lb per sq in.). The capacity (1,520,000 lb) of the suspenders at each panel point provides a factor of safety of three based on the combined dead and live load. For live load only, the factor of safety is five.

The theoretical dead load carried by the severed suspender was 130,600 lb, or 65,300 lb per part. A first approximation of the redistribution of this load to the adjacent suspenders was made by assuming that: (1) the main cable retained its parabolic form which, for flat parabolas, is very nearly circular; (2) the load distributed by the stiffening truss beyond the fourth suspender either side of the severed one could be neglected; (3) the rocker post replaced two imaginary panels at the tower; and (4) the stiffening truss did not take any stress. It was believed that the distribution of the loads in this manner was conservative and that the calculated loads on the suspender ropes would be higher than actually existed.

SAN FRANCISCO–OAKLAND BAY BRIDGE, WITH LOCATION OF AIRCRAFT COLLISION INDICATED

The original analysis by the deflection theory showed that the side-span stiffening truss at the $^1/_{10}$ point from the tower takes a considerable portion of the live load when the side span is uniformly loaded; therefore a second approximation was made assigning part of the 130,600 lb to the stiffening truss. Figure 1 shows the calculated deflections of the main cable and the stiffening truss, assuming that the truss carries $^1/_9$, or 14,000 lb. The field measurements and jacking loads required to place the new suspenders closely checked this assumption; however, the writer questions whether these were accurate within 10%. The calculated spreading of the main cable and truss was 1.02 in. The measured distance that the rope sockets had to be pulled was about $4^1/_2$ in. when the jacking equipment was hanging freely from the suspender rope.



FORCE OF IMPACT DROVE SUSPENDER INTO 4-IN. EXTRA-STRONG PIPE RAIL

Suspender 121NE has a length of 432.7 ft; the cross section is 2.44 sq in.; and with a modulus of elasticity of 20,000,000 lb per sq in., a load of 18,750 lb is required to elongate the rope one inch. The total elongation for the load of 130,600 lb is 6.96 in., or 3.48 in. per part which, added to the 1.02 in. calculated as the spreading of the truss and main cable, equals the measured amount. As nearly as could be judged by the pressure gage on the pump for the hydraulic jack, the exerted load was 185,000 lb for suspender 121NE and about 165,000 lb for suspender 121NW.

As to the strength of the stiffening trusses of the San Francisco–Oakland Bay Bridge, the members have the general areas which would be required for a simple-span bridge of from 120 to 210 ft (4 to 7 panels), the capacity being limited by chord section near the towers and web areas at the center of the span. Considering the probabilities of maximum loading, the redistribution of loads, factors of safety, and so forth, probably four sets of suspenders on each side, or five or six sets on one side, could be removed without making the collapse of the bridge imminent.

The San Francisco–Oakland Bay Bridge is owned by the State of California. It is operated by the Division of Highways of the Department of Public Works. Charles H. Purcell is the Director of Public Works and Chief Engineer of the San Francisco–Oakland Bay Bridge; George T. McCoy, State Highway Engineer; and Howard C. Wood, the Principal Bridge Engineer for the San Francisco–Oakland Bay Bridge. All three are Members of ASCE.

Government Employees' Organizations Appraised

SHOULD a government agency require employees to be members of an association?

Should government employee organizations have the right to strike?

These and similar questions covering public employer-employee relations today are raised and answered in a report recently issued by the National Civil Service League, 67 West 44th Street, New York, N.Y. Prepared by the League's Committee on Public Employer-Employee Relations, made up of educators, business and industrial leaders, public and Civil Service administrators, and two men prominently associated with CIO and AFL labor organizations, the report supplements earlier expressions of the League on employee organizations. The purpose of the report is to cite some of the fundamentals of public personnel relations and what public service requires with respect to the relations of government with employee organizations.

In question-and-answer form, the report sets forth the differences between private and public employment and points out that:

"During the past two years the League has observed with increasing concern the tendency of organized civil service employees to seek to transplant to the public service from private industry certain employer-employee arrangements which are neither necessary nor desirable in the public service. The League recognizes that public employees have their grievances—sometimes real and sometimes fancied—and that it is the responsibility of government to establish machinery to assure that they have justice."

NO PRESSURE PERMITTED

The answer to the question: "Should a Government Agency Require Employees to Be Members of an Association?" is given in the report as:

"Permitting an organization, without interference, the opportunities it needs to make its work known to its members, affords it an adequate basis for influencing a substantial and continuing majority of the employees in a government unit and perhaps even for complete membership. But no pressure by a government unit can justifiably be put on an employee to join a particular association in order to get or retain his job and only

To civil engineers, whose largest employer is the public—federal, state, and local government—a recently published report by the Committee on Public Employer-Employee Relations of the National Civil Service League should be of particular interest. Timeliness of the report is emphasized by the light it sheds on current thinking on the subject of collective bargaining, which has been so prominent in the considerations of Society members of late. It is significant, also, that the League's Committee on Public Employer-Employee Relations includes—in addition to professors, business and industrial leaders, and high-ranking Civil Service administrators—J. Raymond Walsh, formerly economist, CIO, and now chairman of the New York Citizens' Political Action Committee, and Arnold S. Zander, president of the American Federation of State, County and Municipal Employees (AFL), Madison, Wis.

capacity to do that job, or some other broad criterion, is appropriate to a democracy."

Answering the query, "Should Government Employee Organizations Have the Right to Strike?" the report points out that police, health and fire services, among others, are essential to society, urges government agencies to be sympathetic toward employee problems and to increase machinery for understanding employee grievances, and concludes:

"It is the duty of the state to avoid unfavorable conditions of public employment and provide adequate machinery for the prevention and removal of employment problems at their source. But when the state fails in that duty it still remains the obligation of public employees to limit the presentation of their case to peaceable methods."

Another question posed is:

"Should Public Employees Be Allowed to Organize?"

The answer given is:

"In keeping with the times, an administrator should not interfere with such mere act of association by employees. He should acquaint himself with the rulings of labor boards defining such interference. It is desirable for him to give such groups, when functioning properly and not in opposition to the public interest, an open-minded, friendly cooperation. He should bear in mind, however, as most employee associations do, that recognition of them does not require the use of all the organization procedures which happen to be employed by non-governmental groups in their industrial relations."

"Should Outside Affiliations of Employee Organizations Be Forbidden?"

This question is answered as follows:

"Public bodies are justified in the prohibition of outside affiliation by any group in government service solely when the danger of partisanship or impaired public confidence is real. A general, indiscriminate attempt to dominate the form of organization desired by employees is out of step with the times."

PUBLIC SERVICE CONSIDERED

Still another question is:

"Should One or Several Organizations in a Department Be Recognized?"

An administrator would do well to study prevailing practice, the report advises, and it states:

"While no uniform rule can be suggested here, since circumstances of the given case have a bearing on the question, the administrator should take his stand on the principle that that form of organization is justified which is best for the efficient operation of the public service."

In conclusion, the report states:

"The relations of government units with employee associations involve some of the most difficult and delicate problems of democracy. The development of appropriate and effective procedures requires from all the parties concerned an open-minded, experimental and forward-looking attitude.

"The administrator, on his part, must recognize his paramount obligation of democratic leadership of his unit and at the same time his responsibility to the public at large. Associations of employees must likewise integrate their desires for better conditions for their members with the interests of public administration as a whole. Citizens generally, as well as the representatives who exercise legislative and other authority in their behalf, must do their part in providing the conditions which preserve these interests and obligations and promote the development of the government service toward a model democratic institution."

Irrigation Needs for Northwest Estimated

Storage of Seasonal Runoff Essential to Sustain Crops

By LEE MCALLISTER

ENGINEER, BUREAU OF RECLAMATION, SALEM, ORE.

To provide a balance between food production and the increased population and industrial development of the Pacific Northwest, extensive irrigation of fertile but dry valleys is called for. A broad program has been outlined, with the Bureau of Reclamation and the Army Engineers cooperating, which will provide needed water for thousands of acres. These plans were revealed by Mr. McAllister at the Spokane meeting of the Irrigation Division.

IN the northwestern corner of the United States, west of the Cascade Mountains in Oregon and Washington and north of the Rogue River Basin, lies an area rich in natural resources, destined one day to take its rightful place in the development of our nation. It is a compact region, 120 miles wide and 440 miles long, set off from the rest of the country by natural boundaries and surrounded by areas of entirely different physiography and climate. Richly endowed with natural resources of land, forests, water, and scenic attractions, it is an agricultural area studded with numerous cities, towns, and rural communities.

FIG. 1. VARIATION IN PRECIPITATION OVER REGION WEST OF THE CASCADES

The region is generally considered to have a humid climate. However, an extremely important and less widely known characteristic is the wide variation in precipitation both in location and in season. Precipitation results mainly from the easterly movement of atmospheric-pressure depressions out of the North Pacific Ocean. In summer these cyclonic disturbances follow a path far to the north and are more infrequent. In winter their paths move further south and many pass directly over the region. When this occurs, a general storm covers a large part of the area. The transition between wet and dry seasons is gradual. December is ordinarily the wettest month of the year, while the dry season reaches its climax in July.

VARIATIONS IN PRECIPITATION

Topography is responsible for the wide geographic variation in precipitation. Elevations vary from sea level to in excess of 14,000 ft for Mt. Rainier, the highest peak in the Cascades. The general elevation of the Cascade Range is about 6,000 ft. General elevations in the Coast Range increase from about 2,000 ft at the southerly end to some 6,000 ft. The Olympic Mountains, in the northwestern corner of Washington, rise to an elevation of some 7,900 ft. The coast west of this range is rugged and adjoined by a few flat areas. A geologic trough forming the Willamette Valley in Oregon and the Cowlitz and Lewis valleys in Washington separates the Coast and Cascade ranges in the central part of the region. The two ranges are further separated to the north by Puget Sound.

Precipitation is largely in the form of rain at lower elevations, where during many winters no snowfall is recorded. The snowfall increases with altitude, and at some places in the Cascades more than 500 in. a year is recorded. Records published by the Weather Bureau, U.S. Department of Commerce, have been assembled and compiled, and they form the basis for the findings that follow.

The map, Fig. 1, shows the variation in precipitation over the region.

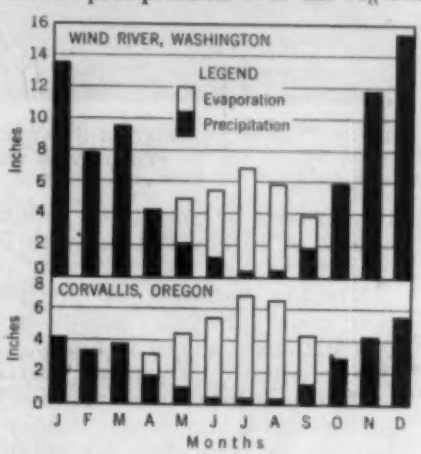
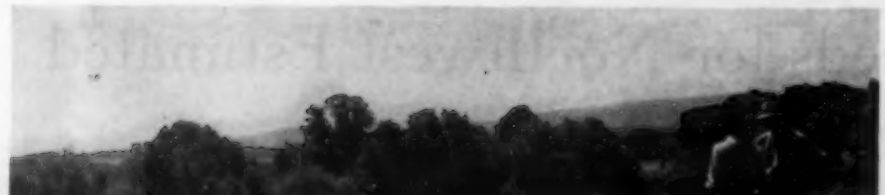


FIG. 2. MONTHLY VARIATION IN PRECIPITATION AT WIND RIVER AND CARVALLIS—MEAN OF FIVE DRY YEARS

Average annual and summer precipitations for 98 stations were computed for the period 1930 to 1945. All rainfall in the five months of May to September was considered summer precipitation. To illustrate the variation, the 6-in. and 10-in. isohyetal lines of summer rainfall were sketched on the map. The effect of topography on the distribution of rainfall is apparent from the location of the area within the 6-in. isohyetal. One of these areas, covering the lower elevations in the Willamette Valley, results from the shielding effect of the Coast Range. Similarly, the Olympic Mountains shield the dry area bordering the Strait of Juan de Fuca from the prevailing northeastward-moving storms. Irrigation is practiced in an area somewhat more extensive than that bounded by these 6-in. isohyetals.

All the 98 stations had records for 12 or more full summers over the period 1931 to 1945. Stations with shorter records were not plotted. The average rainfall for stations having incomplete records was adjusted to a



IRRIGATING STRAWBERRIES AND SMALL FRUITS BY GRAVITY IN THE WILLAMETTE VALLEY

16-year basis by comparison with the nearest of 15 key stations with full records.

Monthly variation in precipitation under dry-year conditions at two stations is shown in Fig. 2. To illustrate the duration and severity of the dry season, pan evaporation for each month is also shown. Choice of stations for comparing precipitation and evaporation was limited. These two stations, Corvallis and Wind River, are the only ones in the region having continuous evaporation records from 1931 to 1945. To show dry-year conditions, the five years of low summer rainfall, 1934, 1935, 1938, 1939, and 1944 were averaged. These years throughout the region had dry summers, but not necessarily the five driest at every station.

Where irrigation is now practiced in the region, evaporation exceeds rainfall during the six-month period April to September. The actual water requirements for crops actively growing throughout the six months would be 20 to 40% less than pan evaporation, with about the same monthly distribution.

Periods of deficient rainfall in each summer since 1930 are shown in Fig. 3, for three stations. These stations —Sequim and Everett, Wash., and Salem, Ore.—are representative of areas where irrigation is now practiced and lie within or near areas bounded by the 6-in. isohyetal. At any time during the period shown by heavy lines on the charts, the total rainfall for the preceding 20 days was less than $\frac{1}{2}$ in. Less than 5 in. of summer rainfall were recorded in 10 of the 14 years of record at Sequim and in 6 of the 15 years of Salem. Summer rainfall in this area is generally less than in the Great Plains area east of the Rocky Mountains. Periods of summer drought when no rain falls, or when it is so light as to be ineffective for plant growth, commonly have a duration of 40 to 60 days, and occasionally longer. Growing crops dependent upon rain would definitely be suffering a drought condition during these periods. The optimum water requirement for practically all crops is much greater than 0.50 in. per 20 days.

The present success of farming without irrigation in these drier areas results from the early maturing of crops, which can draw on soil moisture for the short dry period before harvest. The choice of crops is therefore greatly limited. The short, more widely separated dry periods at Everett as compared with the other two stations on the chart are illustrative of the less arid condition, where irrigation is desirable to supplement rainfall. In areas where the dry periods are of longer duration, late-season crops will be dependent largely upon irrigation.

Irrigation development to increase and diversify agricultural production is needed to provide enlarged opportunities in this region. Past development has proceeded slowly, in part because of the over-appropriation of surface-water supplies and the lack of available ground water except in small areas.

Estimates indicate that, in addition to areas now irrigated, a quarter of a million acres in Washington and a half million in Oregon west of the Cascades would be benefited by irrigation. In Washington these lands extend from Sequim to Vancouver; in Oregon, the largest area is in the Willamette Valley.

A large part of the crop land is now devoted to deep-rooted orchard crops and fall-planted annual grain, hay and seed crops. Natural precipitation usually supplies ample moisture for fair yields in most years. Although these lands would not be irrigated as it is not desirable to place all the agricultural lands under irrigation, but an increase in the irrigated acreage through the establishment of a number of well-planned projects would stabilize the agricultural production of the area and provide the principal means of intensifying the

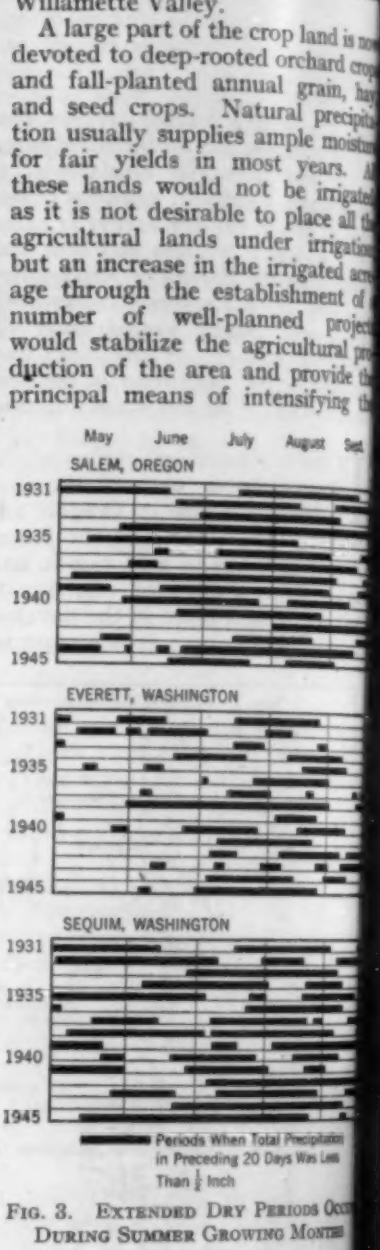


FIG. 3. EXTENDED DRY PERIODS OCCURRING DURING SUMMER GROWING MONTHS

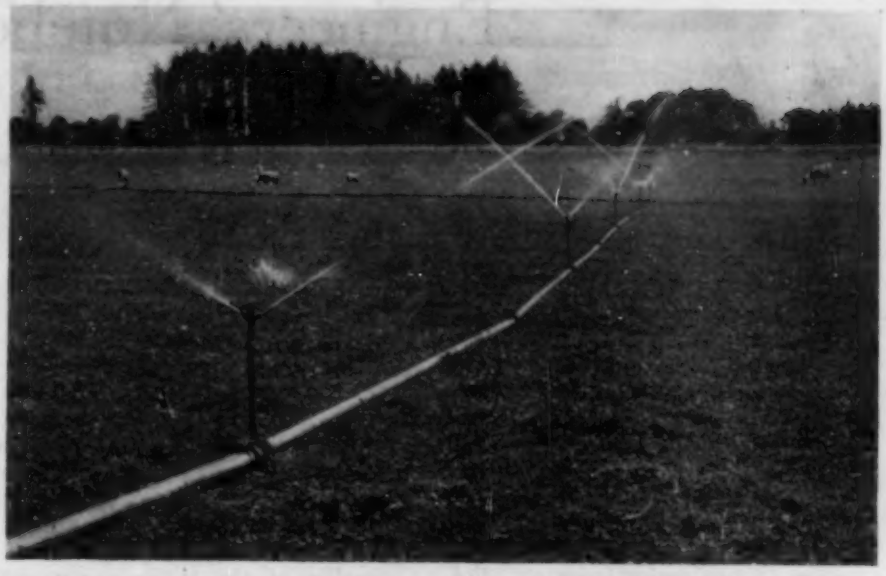
use of a considerable acreage of land now in farms. An increase in the agricultural production which would result from such irrigation development is necessary in order to provide a proper balance between food production and increased population and peacetime industrial development in the Pacific Northwest.

During 1946 some 35,000 acres and 80,000 acres were irrigated in this section of Washington and Oregon, respectively. Probably 80% of this area was served by sprinkler systems and the remainder by gravity.

At least four crops now grown on a considerable scale are dependent upon irrigation water for successful production. These are snap beans, carrots, and beets for processing, and ladino clover for pasture.

Snap beans are an outstanding irrigated crop of the area. Their acreage has steadily increased since the crop was first handled commercially. In 1934 in Oregon there were only 900 acres, all in the Willamette Valley. By 1940, this crop had increased to 2,200 acres, and it reached 4,500 acres in 1945, with a farm value of more than three million dollars. About 1,000 acres of snap beans are grown annually in the West Stayton area on lands that had little value before irrigation water was applied.

Ladino clover for pasture is one of the most extensive crops irrigated in the region. Irrigation of this crop has proved very profitable on dairy farms. Two dairy cows can be pastured on an acre for six months of the year. Three months of this pasture is produced at a time when most other forage crops are dry and unpalatable. The acreage of ladino clover would increase considerably if irrigation were available. Dairy men have found this crop an effective way of increasing milk production, but most of them cannot grow ladino clover until they are assisted in obtaining water.



WILLAMETTE VALLEY LADINO CLOVER FIELD UNDER SPRINKLER IRRIGATION

FUTURE PLANS

From a study of present conditions it is apparent that irrigation cannot develop appreciably further until the surplus winter flow is stored for summer use. The supply when stored would be ample for irrigation purposes, and large blocks of arable lands would benefit during periods of summer drought. The Bureau of Reclamation in 1940 began irrigation studies in the area. In these first studies it was intended to utilize for irrigation purposes only those waters that could be impounded in potential flood control reservoirs after the annual flood-hazard period from November 15 to February 1 had passed. Later the studies were extended to cover full utilization of water for irrigation in other fertile valleys not under flood control reservoirs.

In the Willamette Valley, Oregon, the Bureau of Reclamation is studying a plan to develop the lands and water resources of the basin. This plan proposes the more intensive use of some half million acres of fertile lands through the development of 21 separate irrigation projects spread throughout the length and breadth of the watershed. The type of farming best suited to the area, to what extent irrigation can be made to increase farm income, and the physical means by which full development of these projects can be brought about, will be investigated and made subjects of future reports.

Storage for this irrigation would be provided from two sources: first, from waters that could be impounded in the proposed seven flood-control reservoirs now under construction by Army Engineers; second, from ten additional reservoirs on other Willamette tributaries proposed by Bureau of Reclamation and Army engineers. In addition to contributing to flood control, such reservoirs would supply water needed for irrigation, aid navigation by increasing the dry-season flow, make practicable the production of more electrical energy in the future, and also contribute to the abatement of stream pollution, the preservation of fish and wildlife, and the benefit of recreation.

Near Puyallup, Wash., the Bureau of Reclamation in 1944 began an investigation of the Green-Puyallup Project, embracing some 15,000 irrigable acres. Investigations of other projects are contemplated in Washington in the near future, expecially near Sequim.

In summary, relief from shortage of moisture during the drought months can be expected to expand production, increase diversification, and improve the quality and dependability of agriculture west of the Cascades. This program is more than local; it is an integral part of a greater development plan for the whole Pacific Northwest, and from a still broader viewpoint, it is essential to national progress.

SMALL VEGETABLE CROPS THRIVE UNDER GRAVITY IRRIGATION IN THE WILLAMETTE VALLEY

Engineers' Notebook

Suggestions and Practical Data Useful in the Solution of a Variety of Engineering Problems

Four-Level Highway Grade Separation Adopted After Model Study

By F. J. GRUMM *and* F. W. PANHORST, MEMBERS ASCE

RESPECTIVELY ASSISTANT STATE HIGHWAY ENGINEER AND BRIDGE ENGINEER, CALIFORNIA STATE DIVISION OF HIGHWAYS, SACRAMENTO, CALIF.

A DETAILED model of an interchange structure proved most valuable to the California Highway Department in designing a structure to unscramble traffic at the intersection of two major freeways. Following detailed attention to several common types of interchanges, designers decided upon a unique four-level separation. Advantages of the chosen design are:

1. Minimum length of travel for interchanging traffic
2. Adequate capacity for large numbers of vehicles during peak periods
3. Simplified, or natural, paths of travel

This innovation in grade separations will be constructed at the intersection of the Hollywood Freeway and the Arroyo Seco Freeway at the north end of the central business section of Los Angeles, Calif. At this point two other traffic arteries also terminate, the Santa Ana Freeway and the Harbor Freeway. In addition to through traffic and traffic bound for destinations in the city, these freeways serve a very large volume of commuter traffic between outlying residential areas and the central business district of Los Angeles.

TRAFFIC STUDIES

Studies of the traffic movements show, for instance, that 25% of the incoming traffic on the Hollywood Freeway will turn right at this intersection to enter the Harbor Freeway and proceed to more southerly exits from this freeway, closer to destinations in the central and lower part of the business area. Conversely, in the evening this same traffic will turn at the intersection to proceed westerly on the Hollywood Freeway.

The large volume of traffic changing its course at this intersection imposes a serious problem. The usual types of interchange structures, such as the cloverleaf and the widely spread intersection, would not be appropriate and decidedly inefficient. A cloverleaf would impose considerable additional length of travel and would be unable to handle adequately the large volume of traffic involved. On the other hand the extremely high cost of right of way militates against the use of the widespread type of intersection. In each of these methods, moreover, some complexity of movement is involved. Concentrated study of the problem finally led to the adoption of the four-level structure suggested by W. H. Irish, Senior Highway Engineer, District VII, Los Angeles.

Many three-level structures have been designed and built, but the writers know of no other existing four-level structure of a similar nature. On account of the various curvatures, grades, and alinements of the different roadways, it was difficult to envision the appearance of a composite structure with any degree of assurance. It was also difficult to design supports for the roadways without having the columns land in one of the traffic lanes at some other elevation. Even minor revisions in the plans would affect the appearance of the overall structure.

MODEL PROVES HELPFUL

For these and other reasons, it was considered advisable to construct a model of the proposed intersection. A scale model was built by E. R. Bradt, of the Bridge Department, from a combination of plaster of paris, airplane model wood, pieces of ordinary fly screen for railings, and various kinds of weeds for shrubbery. It was accurately constructed to a scale of 1 in. = 30 ft, with an overall dimension of 4 ft 6 in. by 7 ft. Automobiles and trucks, cast to scale size, were distributed on the model to simulate the density of traffic recommended by the traffic engineers.

The model was useful and helpful in determining several factors: general appearance, solution of some of the details, size or proportion of parts, needed treatment to secure appropriate surrounding topography, the plan and type of beautification and landscaping. Also it will be of assistance to contractors bidding on the job.

The estimated cost of the four-level structure is about $1,100,000, with an additional $1,700,000 for the adjacent separation structures. The saving in right-of-way cost by the use of the four-level structure over any other type of interchange and separation method is very appreciable. Future savings in operating costs for this structure as compared

FOUR-LEVEL FREEWAY INTERCHANGE DEVELOPED IN MODEL

to any other type are large enough to retire any immediate excess construction costs within a short time. The four-level structure, as proposed, satisfies the several traffic requirements more thoroughly, more readily, and more completely than does any other type of structure we could devise or which has come to our attention.

Sand Traps Designed for Streams with Heavy Bed Loads

By H. A. BURT

ASSISTANT SUPERINTENDENT, PUBLIC SERVICE COMPANY OF COLORADO, DENVER, COLO.

PRACTICALLY all natural watercourses carry varying amounts of silt, sand, and gravel, depending on the locality and the stage of the stream. Particularly in mountainous areas, where parts of streams are diverted into canals for irrigation,

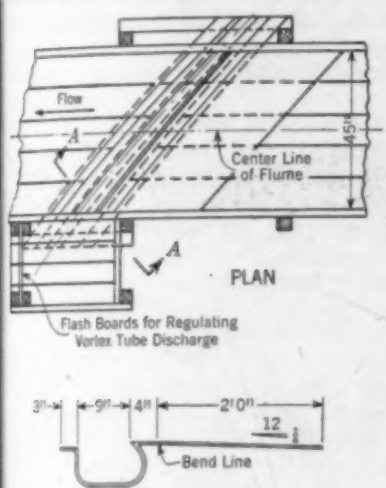


FIG. 1. VORTEX TUBE TRAPS BED LOAD OF STREAM WITH SWIFT FLOW

power, or municipal needs, the silt, sand, and gravel are carried with the diverted water. Then, because of the slower velocity in the canal, these materials either start settling out and deposit on the bed, or they are carried through until they reach a reservoir, or pass through hydraulic turbines. In any event, the presence of these particles causes very heavy maintenance on canals, reservoirs, and hydraulic equipment, and often very seriously reduces their capacity. From the standpoint of irrigation alone, the expense incurred in cleaning ditches is estimated to exceed well over a million dollars annually.

This paper is based largely on the developments accomplished by R. L. Parshall, Assoc. M. ASCE, Senior Irrigation Engineer, Soil Conservation Service, Division of Irrigation, Fort Collins, Colo., and quotes extensively from his paper presented at the convention of the Nebraska State Irrigation Association, December 6 and 7, 1945.

There are three practical designs of sand traps—the vortex tube, riffle deflector, and metal vane deflector.

The vortex tube (Fig. 1) is a tapering channel crossing the bed of the flume at an angle of about 45°. This picks up the bed load of sand and gravel and discharges it outside the flume or conduit. This type of trap works best where the velocity in the channel is high, and its principle of operation is to interrupt the flow at the bottom of the stream so that it can drop the gravel and sand. The downstream edge of the tube is lower than the other by about one-tenth the distance across the throat of the opening. This width varies from 6 in. at the upstream end of the tube to 9 in. at the outlet.

Gravel and sand collected in the tube are washed out of the outlet by the strong spiral flow in the tube. A relatively small loss of water through the tube effectively removes a large part of the bed load of the stream.

A second type of sand trap is the riffle deflector–vortex tube. This trap functions effectively (averaging 90% removal) when the bed load of the stream is sand of varying degrees of fineness, up to small cobblestones,

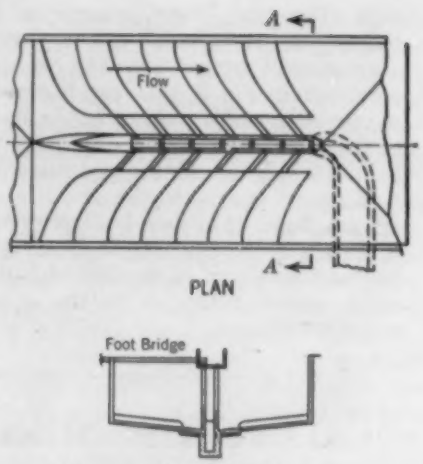


FIG. 2. RIFFLE-DEFLECTOR SAND TRAP COLLECTS SAND FROM STREAM WITH MODERATE VELOCITY

and the velocity is moderate. This type of sand trap is shown in plan and section in Fig. 2. The riffles are shown as a series of parabolic lines extending from each side of the flume toward the middle, where a series of vortex tubes appear. The riffles throw the bed load toward the vortex tubes, which trap the sand and discharge it into the middle chamber, from which it is drawn off through a rectangular duct and discharged back into the natural stream.

This type of trap is suitable for both small and large channels. For ditches 8 to 16 ft wide, the series of riffles should be on one side, with the vortex tubes and outlets on the opposite side. For larger canals, with a discharge ranging up to 1,000 cu ft per sec, it would be desirable to place the riffles along each wall, arranged to discharge the bed load toward the middle, where the vortex tubes trap it.

A third type of trap is the metal vane deflector, which works with

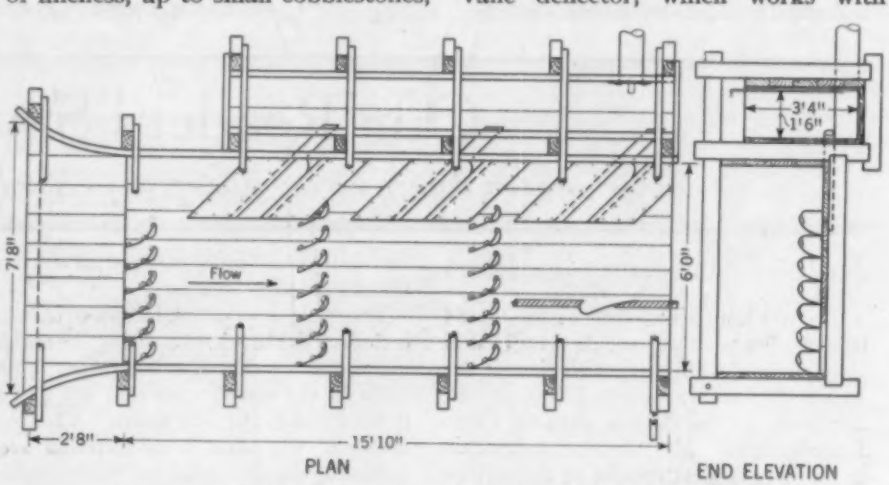


FIG. 3. SAND TRAP WITH METAL VANE DEFLECTORS DIVERTS SAND BED LOAD TO COLLECTING TUBES

high efficiency in removing fine to coarse sand from small streams with a velocity of around 2 or 3 ft per sec. As shown in Fig. 3, this trap has rows of curved metal vanes set in the floor of the structure. The vanes are 6 to 8 in. in height and are spaced 6 to 8 in. apart, normal to the direction of stream flow. The bed load accumulates in a ridge downstream from the line of vanes and is washed into the short vortex tubes as in the other traps mentioned.

The sand traps here discussed are dependent primarily on having the troublesome materials traveling on the bottom of the channel. They have no effect on particles being carried in suspension. The velocity of the water flowing in the channel, the smoothness of the channel surfaces, and the fineness of the sand particles are the chief factors which determine how the sand particles are traveling.

This paper was presented before the Spokane meeting of the Sanitary Engineering Division.

Diversion Structure for Combined Sewer Picks up Sanitary Flow

By BEN S. MORROW, Assoc. M. ASCE
CITY ENGINEER, PORTLAND, ORE.

SINCE the Portland, Ore., sewers carry both sanitary sewage and storm waters from streets and roofs, diversion structures have been designed to take the sanitary sewage from each sewer so that it can be diverted to the new disposal plant now being planned. During rainy periods, it is desirable to limit this diversion while the surplus, mostly surface drainage, passes down the sewer without treatment to the present outfall. It is desirable to keep as much of the grit out of the interceptor as possible. The bed load and a share of the suspended grit should pass on down the main sewer.

DESIGN DEVELOPED

In an effort to arrive at a design of diversion structure that would meet these requirements, model studies were made in a local hydraulic laboratory by J. C. Stevens, M. ASCE. As a result, effective diversion structures have been designed and one full-sized unit has been constructed.

This diversion unit (Fig. 1) consists of a U-shaped structure in the side of the sewer. In the center of this is a circular horizontal orifice through which the sewage enters the connecting line to the interceptor. The size of the horizontal orifice may be varied by substituting orifice plates of desired diameter.

The diversion into the U-shaped structure containing the orifice is over a weir crest higher than the invert of the sewer. The weir slopes upward at the downstream end, so as to prevent the grit carried as bed load in the sewer from being taken into the diversion structure by the deflected flow. Just downstream from the diversion structure, a dam is constructed in the main sewer with an upstream sloping face, the height of this dam being just sufficient to divert the sanitary flow.

In the diversion structure, all flow through the orifice is characterized by a vortex, the effect of which is to reduce the flow, so that it is less than normal orifice flow would be without vortex action.

This article is taken from a paper presented before the Sanitary Engineering Division session at the Spokane Convention.

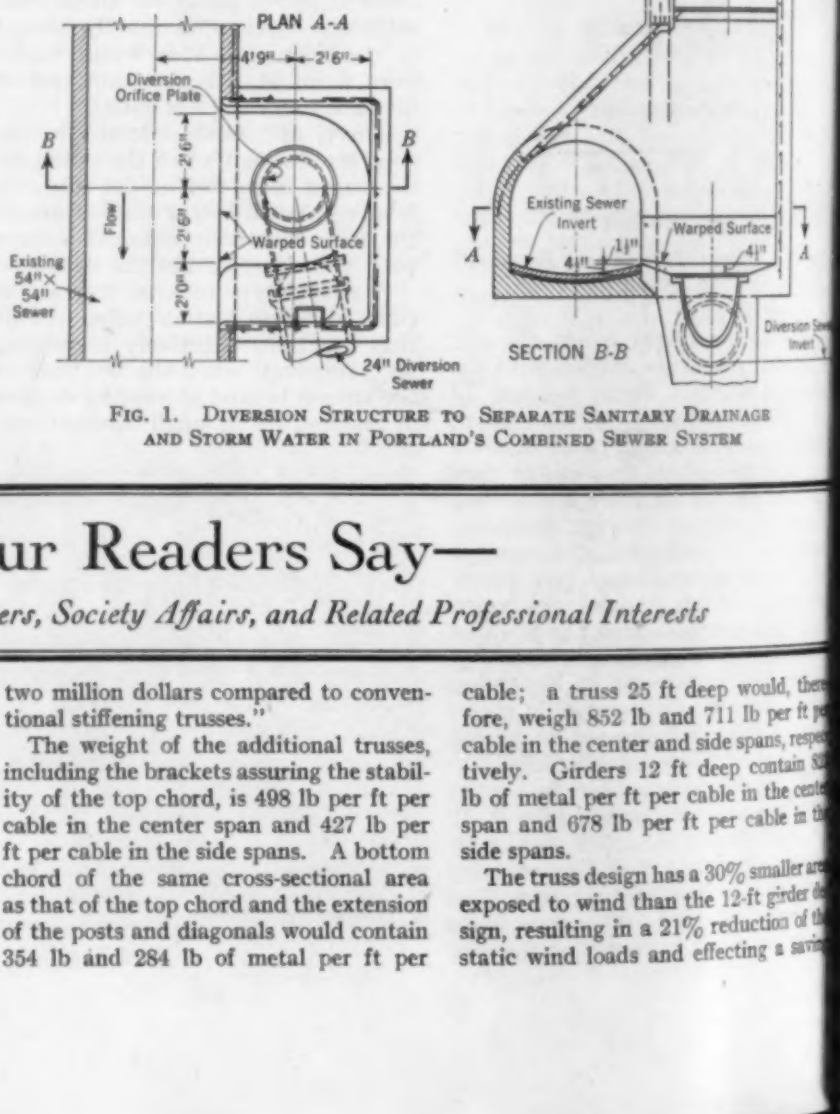


FIG. 1. DIVERSION STRUCTURE TO SEPARATE SANITARY DRAINAGE AND STORM WATER IN PORTLAND'S COMBINED SEWER SYSTEM

Our Readers Say—

In Comment on Papers, Society Affairs, and Related Professional Interests

Role of Stiffening Trusses

TO THE EDITOR: The writer would like to differ with statements contained in the article, "Additional Stiffening of the Bronx-Whitestone Bridge," by O. H. Ammann, in the March issue of CIVIL ENGINEERING. Mr. Ammann states that in " . . .the original design of this bridge . . . . girders of 12-ft depth were adopted . . . .because they permitted a saving of two million dollars compared to conventional stiffening trusses."

The weight of the additional trusses, including the brackets assuring the stability of the top chord, is 498 lb per ft per cable in the center span and 427 lb per ft per cable in the side spans. A bottom chord of the same cross-sectional area as that of the top chord and the extension of the posts and diagonals would contain 354 lb and 284 lb of metal per ft per cable; a truss 25 ft deep would, therefore, weigh 852 lb and 711 lb per ft per cable in the center and side spans, respectively. Girders 12 ft deep contain 52[illegible] lb of metal per ft per cable in the center span and 678 lb per ft per cable in the side spans.

The truss design has a 30% smaller area exposed to wind than the 12-ft girder design, resulting in a 21% reduction of the static wind loads and effecting a saving

of 72 lb of metal per ft of bridge in the lateral bracing and, in addition, a saving of 6% of the tower metal, or 816,000 lb. It appears that no saving was achieved by the use of 12-ft girders as compared to trusses 25 ft deep, having 20,080 in.²-ft² and 15,600 in.²-ft² moment of inertia per truss in the center and side spans, respectively.

Applying the ratios of depth to span and moment of inertia to the square of span of the Detroit River, Golden Gate, and Lions Gate bridges to the Bronx-Whitestone Bridge, the depth of its trusses would become 27.35 ft, 13.69 ft, and 23.75 ft, averaging 21.6 ft, and the required moment of inertia of each of its trusses would become 24,400 in.²-ft², 17,500 in.²-ft², and 20,060 in.²-ft², averaging 20,600 in.²-ft². The truss 25 ft deep described in the foregoing is, therefore, within the conventions of the period of the design of the bridge. The maximum combined moment of inertia of the existing girders and the additional trusses is 19,836 in.²-ft², which ". . .was considered ample to provide adequate stiffness . . ." as confirmed by Mr. Ammann.

It is thus evident not only that no saving resulted from the use of the 12-ft girders as compared to conventional trusses, but also that it is impossible to achieve a two-million-dollar saving by the use of them.

Referring to the improvement of the original design in 1937, Mr. Ammann states, ". . .certain modifications in the design were made which tended further to reduce the rigidity. . . ." These modifications—reduction of the weight of the floor slab by 1,210 lb per ft per cable, increase of the sag ratio to 1:11½, and reduction of the girder depth to 11 ft—reduced the cable pull by 25%. The consequent saving in metal and concrete came to about a million dollars.

The reduction of weight failed also to increase the aerodynamic oscillations. This is evident from the fact that during construction ". . .the increased dead weight due to placing of the floor concrete. . .proved to have little effect." It should be noted that the added weight of the concrete was 1,630 lb per ft per cable in the roadway and sidewalk, or 30% of the total dead load. The stiffness difference between 12-ft and 11-ft girders is negligible. However, the shallower girders reduced the static wind loads by 8%, and probably resulted also in better aerodynamic behavior than the deeper ones. It is rather certain, therefore, that the modifications did not reduce the aerodynamic rigidity of the original design.

Concerning the deflections, Mr. Ammann states, "The addition of the truss members has the effect of increasing. . . . resistance. . . to deflection under a uniform load. . .about 60%." That deflections of the center span cannot be materially reduced by reasonable trusses has been common knowledge and was one of the reasons for the decline of the stiffening truss when only the structural elastic stiffness, measured by live-load deflections, was the criterion in design. Unless stated, deflections refer to the design live load, but neither for the design live load nor for 100 lb per ft per cable load will any significant deflection be reduced 60% by the additional trusses.

LOUIS BALOG
Consulting Engineer
New York, N.Y.

Model and Prototype Studies Compared

TO THE EDITOR: The comparison of model and prototype performance on the spillway of Fontana Dam, as described by Mr. Peterka in the June issue, is extremely interesting—particularly as the comparison verifies model studies for the dissipation of energy by use of the jet involving large volumes of flow.

However, there appears to be some divergence between the results shown in Figs. 1 and 2 and the statement in the text. In referring to these figures, Mr. Peterka states, "It will be noted that here too the model shows a longer trajectory than the prototype." This statement does not appear to be borne out in the figures. In Fig. 1, which is captioned as model channel at discharge of 12,500 cu ft per sec, the limits reached by the jet are approximately 375 ft from the reference point at the end of tunnel No. 2. In Fig. 2, captioned prototype channel at discharge of 10,000 cu ft per sec, the limit of the jet is indicated at about 525 ft from the same reference point.

It appears that the distance traveled by the jet in the model was considerably less than in the prototype. These results would be possible only because of lack of exact similarity between the discharge in the model and prototype. Two factors contribute to this divergence. In the first place, the ratio between Kutter's coefficient of roughness in the prototype and the model varies as the sixth power of the scale ratio. For material such as concrete, it is usually impossible to build a model having a sufficiently smooth surface to obtain the proper coefficient of roughness unless the scale ratio between prototype and model is rather small. Hence, retardation in most open-channel model studies is much greater than will occur in the prototype. Another factor that influences the velocity of flow in the prototype is caused by entrainment of air in the water at high velocities. This phenomenon is clearly shown in the photographs of the prototype contained in the article, but is practically nonexistent in the photographs of the model.

Tests in actual channels made by the writer indicate that the retardation coefficient in the Manning formula for the mixture of air and water is the same as would be expected from water alone ("Entrainment of Air in Flowing Water, Open Channel Flow at High Velocities," by L. Standish Hall, TRANSACTIONS, Vol. 108, p. 1393). At the same time, velocities are accelerated above those determined by normal hydraulic computations. The reason for this is obvious, if the Manning formula is solved for "*V*." The entrainment of air increases the cross-sectional area and, hence, the value of the hydraulic radius of the mixture, more than offsetting the slight reduction in the friction slope. As a result, with "n" unchanged the velocity of the air-water mixture is increased with greater insufflation.

Assuming that the terminal velocity of 120 ft per sec is correct for the Fontana spillway, and assuming a value of the coefficient of air entrainment (K = 0.005) and also that the 34-ft diameter tunnels were flowing approximately one-half full, the percentage of water in the mixture would be about 80%. This entrainment of air would increase the velocity above that computed for discharge without allowance for air entrainment. The greater velocity would result in carrying the jet to a greater distance than determined by the model tests or even from conventional hydraulic computations.

It is true, as mentioned by Mr. Peterka, that the larger cross section of the jet in the prototype due to air entrainment would result in greater air resistance to the flow which would partially offset the effects of the higher velocities. However, the velocities were sufficiently in excess of those determined in the model to carry the jet about 150 ft further than indicated in the model tests.

It is also interesting to note the observation that the discharge from the tunnels of Fontana Dam disclosed that aeration did not occur throughout the full depth of the flow. Ehrenberger determined that aeration did not occur throughout the depth for certain of the tests that he performed ("Flow of Water in Steep Chutes with Special Reference to Self-Aeration," by R. Ehrenberger, *Osterreichischen Ingenieur und Architecktenvereines*, Nos. 15/16 and 17/18, 1926). In the tests made by the writer involving relatively small depths of water, a complete aeration throughout the entire depth was observed. The observations at Fontana spillway that, with greater depth of flow and larger quantities of water, full aeration of the discharge does not occur, confirm Ehrenberger's earlier studies in small test channels.

L. STANDISH HALL, M. ASCE
Oakland, Calif.

SOCIETY AFFAIRS

Official and Semi-Official

350 Attend Annual Convention in Spokane, Wash.

Seven Technical Divisions Hold Sessions

HIGHLIGHT of the Annual Convention of the American Society of Civil Engineers was a guided excursion to Grand Coulee Dam. This inspection trip followed a two-day series of Technical Division meetings held on July 17 and 18 in the Davenport Hotel in Spokane, Wash. Other outstanding features of the 74th Annual Convention included social gatherings, sightseeing trips, and business meetings.

GATHERING ENTHUSIASTIC

Plaudits go to the hard-working meeting committee headed by Thomas H. Judd. No details were overlooked that would add to the success of the week in Spokane. As evidence of the enthusiasm current at the meeting, we can cite Walter H. Samson, who flew from Hawaii for the Convention despite the certainty (when he left Honolulu) that no return transportation was available. Last we heard Samson was about ready to buy a half interest in Pan American so that he could get a return reservation.

General meetings and technical sessions followed established custom for summer conventions. Activities were formally opened on Wednesday morning, July 17, by Harold Doolittle, President of the Local Section. On hand to welcome the visitors to Spokane was Stanley Whitter, city recreation director of the Spokane Park Board, who represented Mayor Arthur Meehan. The warmth of his welcome prompted President W. W. Horner to term it a "typically Western welcome."

PRESIDENT GIVES ANNUAL ADDRESS

In his Annual Address, President Horner called "professional improvement of our members" the Society's "most intangible, though perhaps most valuable, aim." He addressed most of his remarks to the younger members of the profession, pointing to the opportunities open to them for active participation and leadership in Society affairs. His address is printed on page 333 of this issue.

In another address, President Horner told the Local Sections Conference representatives that Society affairs must be carried on to a greater degree at the local level, and advocated educational campaigns among the membership at large in connection with various phases of the economic status of the engineer.

Another thought-provoking speech was presented by John W. Haw, St. Paul, Minn., Director of Agricultural Development for the Northern Pacific Railway. (See page 335). Mr. Haw advocated that reclamation of Western wasteland have preferred treatment among postwar federal appropriations, because it is "good business" for the country in these times of food shortage and is a means of expanding the nation's economy. He emphasized the need for "a better public understanding of the important and vital part irrigated agriculture plays in our national economy" and pointed out that "one-fourth of the world's population not only lives on irrigated lands, but are both fed and clothed almost exclusively by the products they produce." These civilizations, he stressed, "date their antiquity, not in hundreds, but in thousands of years."

An opportunity to bring the engineers, their wives, and their guests together came at the general luncheon Wednesday noon in the Hotel's Marie Antoinette Room. The spirited hubbub of conversation was halted only for the address of W. Walter Williams, President of Seattle's Continental, Inc., who traced the development of the Pacific Northwest from "Fur Traders to Furnaces." (See item on page 370 of this issue.) As the party broke up, the technical sessions for the afternoon largely claimed the men's attention while the ladies trooped off under the guidance of Mrs. T. H. Judd to thoroughly "do" the Spokane Museum and Historical Society, with book review and entertainment and refreshments as added attractions. It must be mentioned that Mrs. Judd and her committee had prepared a grand program.

MANY FEATURES FOR LADIES

Chairman of the ladies' entertainment committee was Harold J. Doolittle, president of the Spokane Local Section. A thorough a job did his hard-working committee do that practically every minute of the time was planned for. As a matter of fact the only complaint heard was that the ladies didn't have enough time to do unless they missed some of the activities. The museum trip on Wednesday afternoon, on which the ladies learned about Indian lore, was followed by a grand dinner and entertainment in the evening.

Thursday afternoon and evening were likewise filled to the brim with entertainment, planned and spontaneous. The hours of the afternoon sped by at the Spokane City Club, where an entertainment consisting of games for which prizes were awarded, was presented to the amusement of the ladies. Then on Thursday evening the whole party set off by bus to see the city, traveling through parks and residential districts and on scenic drives, arriving finally at the Spokane Country Club, where a buffet dinner was served in a pine grove near the clubhouse. Then on Friday, of course, the ladies also enjoyed the Grand Coulee trip.

ATTENTION TO MATTERS TECHNICAL

Of course throughout the Convention continuous attention was given to matters technical. The special Tech-

Fall Meeting of ASCE in Kansas City, Mo., October 16–18, 1946

Continental Hotel to Be Meeting Headquarters

KANSAS CITY, Mo., will be host to the Fall Meeting of the American Society of Civil Engineers, to be held from October 16 to 18, 1946. The convention will open with a general meeting on Wednesday, October 16, with technical sessions on Wednesday afternoon and all day Thursday, October 17. Tentative plans indicate that sessions of the City Planning, Engineering Economics, Highway, Sanitary Engineering, Structural, and Waterways Divisions will be held. The meeting will close with an excursion on Friday, October 18.

Owing to the crowded conditions that will prevail, members should request hotel space as early as possible. After space reserved at the Continental has been exhausted, the Registration Committee will endeavor to place reservations at other hotels.

Make your hotel reservation early by addressing your request to

Mark C. Culbreath
1030 Baltimore, 3rd Floor
Kansas City 6, Mo.

Division meetings were sources of so much informative discussion that separate attention is given to each Division in the accounts on the following pages. Opportunity for ideas and contacts did not end with the reading of papers however. In every corridor, and even at the breakfast tables in the hotel's dining rooms (no need to mention the bar—we take that for granted), experiences and opinions were being discussed with apparent earnestness. Perhaps it can be argued that the carefully prepared papers provide a point of departure for the active minds of the engineers. If so, CIVIL ENGINEERING should have a thousand reporters to catch each new idea that develops in the informal gatherings at these conventions so that the profession can have the new "know how" at its disposal. Anyone want to apply?

SOCIETY SPEAKERS IN DEMAND

During the week of the Convention local business and professional groups recognized the rich source of well-informed speakers which had been brought into their midst for a few days. Seizing upon the opportunity, such enterprising groups invited several officers of ASCE to address them. President Horner, in addition to several speeches at ASCE sessions, delivered an address before the Spokane Chamber of Commerce on Tuesday noon, July 16. His topic was "The Engineering Profession as a National Resource."

Speaking before the Construction and Industry Committee of the Spokane Chamber of Commerce at its Monday luncheon, July 15, Col. William N. Carey, Secretary and Executive Officer, outlined the position of the construction industry in the national economy.

Thursday seems to be luncheon club day in Spokane for on this day four organizations invited ASCE speakers to appear on their rostrums. Past-President C. C. Stevens addressed the Spokane Society of Professional Engineers; Director H. H. Koch appeared before the Kiwanis Club; Director W. D. Shannon spoke to the Rotary Club; and Director H. F. Thomson addressed a meeting of the Lions Club.

MANY THANKS DUE COMMITTEES

Special thanks should be given again to the conscientious and able Spokane committees on arrangements for this splendid summer Convention; to the officers of the Spokane Section; to Mr. Todd, the General Chairman; to Mr. Doolittle, who so carefully planned for the entertainment of the ladies; to Frank Banks for the Coulee Dam excursion; and to many more—so many that space won't permit mentioning them all here.

Benefits from Expansion of Irrigation Shown at Division Session in Spokane

THE "how" and "why" of irrigation, in both the United States and Canada, were discussed thoroughly at the Irrigation Division session. H. D. Comstock, of Billings, Mont., chairman of the Division's Executive Committee, presided.

After brief discussions of the Columbia Basin Project by Frank A. Banks, supervising engineer, U.S. Bureau of Reclamation, Coulee Dam, and H. A. Parker, engineer, U.S. Bureau of Reclamation, members of the Division heard papers on "Evolution of Irrigation in Alberta," by Augustus Griffin, manager, Department of National Resources, Canadian Pacific Railway, Calgary, Alberta, Canada, and "Irrigation West of the Cascades," by Lee McAllister, engineer, U.S. Bureau of Reclamation, Salem, Ore.

All postwar irrigation developments in Canada embrace the theory that irrigation of wasteland increases national wealth and supports more population, and its cost is a justifiable charge against general funds contributed by taxpayers, rather than a burden to be borne directly and exclusively by affected property, Mr. Griffin asserted. He traced the evolution of irrigation in Canada from the privately financed and none-too-successful ventures of pioneer days, and stated that modern irrigation undertakings "provide a general benefit in reducing the wide geographical extent of sparsely settled areas of low productivity dividing the country."

Mr. McAllister advocated irrigation west of the Cascades to "provide a proper balance between food production and increased population and peacetime industrial development in the Pacific Northwest."

Outlining the program of the Reclamation Bureau and of Army Engineers, Mr. McAllister called it "more than a local plan" and said:

"It is an integral part of a greater development plan for the whole Pacific Northwest, destined one day to take its rightful place in the development of our nation, and from a broader viewpoint therefore is also essential to national progress."

Operating Problems at Hydroelectric Plants Feature Power Division Meeting

AUTOMATIC operation of hydroelectric plants and under-water sand traps designed to keep the extensive irrigation and power canals of the country's Western region free from silt, sand, and gravel was discussed at the Power Division session. Arthur T. Larned, New York, N.Y., chairman of the Division's executive committee, presided.

Economies effected by automatic and semi-automatic operation of hydro plants of the New York Power and Light Company, of which he is chief engineer, were narrated by S. O. Schamberger, Albany, N.Y. He stated that in 11 semi-automatic and two remotely supervised stations in his company's system, the average annual savings, based upon 1945 labor costs, are estimated to be approximately $6,800.

"Automatic control operates with greater speed and precision than can be accomplished manually by an attendant, and more rapid fault protection is obtained," he said. "Some isolated stations which become part of a large system through merger or otherwise would have to be abandoned unless reduced operating costs were effected through automatic or semi-automatic operation. In general, a manually operated station which produces less than 5,000,000 kwhr annually would show no profit, while an existing single-unit, automatically operated station may produce as little as 1,500,000 kwhr and still show a profit."

The annual return on the investment to install automatic equipment at the stations of his company "varies from 15% to 1,000%, and averages 53%," Mr. Schamberger said.

H. A. Burt, Denver, assistant superintendent, hydroelectric production and transmission, Public Service Company of Colorado, described three varieties of under-water sand traps developed by R. L. Parshall, senior irrigation engineer, Soil Conservation Service, Division of Irrigation, Fort Collins, Colo. He declared that the practicability of each had been demonstrated under the conditions for which it had been designed and that "tests indicate a fairly high efficiency can be obtained, averaging 90% or more."

The metal and concrete traps, laid across irrigation and power canal beds, have captured silt, sand and gravel, some of the latter of "hen-egg size," Mr. Burt said. He touched upon the potential value of the under-water sand-trap development by stating that "from the standpoint of irrigation alone, the expense of cleaning ditches is estimated to exceed well over a million dollars annually."

Sanitary Engineering Division Told of New Sewage Works

A WAR-DELAYED sewage works for Portland, Ore., progress made in stream reaeration experiments, and plans for pollution abatement on the Willamette River were the subjects of papers and discussions at the Sanitary Engineering Division session, at which Prof. George J. Schroepfer, University of Minnesota, the Division's Executive Committee chairman, presided.

Ben S. Morrow, city engineer of Portland, presented plans for the sewage works his city has been planning for some time, and narrated how residents of the city have been paying sewer service charges since August of 1940, despite the fact that construction of the project has been delayed by the war.

"To date," Mr. Morrow said, "collections have amounted to a little over $1,000,000. From this money, the city has met all expenses in connection with the project, such as cost of collecting the charge, preliminary reports, investigations, engineering fees, and purchase of treatment-plant site. There is a balance of approximately $775,000 in this fund."

After describing the proposed treatment works layout, Mr. Morrow said that, together with $12,000,000 authorized by voters in May 1944, this surplus is available to meet construction costs. The bonds have been sold, he said, and the proceeds invested in government securities which pay a higher rate of interest.

Pollution overloading of streams caused by wartime increases in city populations and industry has stimulated reaeration experiments, and the process of pumping compressed air into the water now "shortens to a considerable degree the length of stream utilized for the oxidation of the waste," Prof. Richard G. Tyler, University of Washington, Seattle, reported in his paper.

Professor Tyler said that while "experience indicates that the stream is a more efficient purification plant than presently used artificial methods of treatment," the process is "too slow for practical application," and stream reaeration now is being utilized as another man-made help for nature, to supplement the functioning of sewage treatment plants.

He cited experiments in progress the last three summers at Park Falls, Wis., where approximately a ton and a half of oxygen per day has been added to the Flambeau River, and expressed the hope that "further large-scale applications of this process will be welcomed by state and federal authorities who shoulder the responsibility of maintaining or reestablishing the purity of our streams and lakes."

A third paper presented was co-authored by Prof. Fred Merryfield of the Oregon State College civil engineering department, Corvallis, Ore., and C. M. Everts, director, Division of Sanitary Engineering, Oregon State Board of Health, Portland. The paper outlined proposed plans for pollution abatement on the Willamette River.

Irrigation and Power Divisions Relate Stream-Flow Forcasting to Reservoir Storage

A JOINT MEETING of the Irrigation and Power Divisions was held, with H. D. Comstock, chairman of the Irrigation Division Executive Committee, presiding.

"Stream-Flow Forecasting for Irrigation" and "The Value of Storage for Power in the Columbia River Basin" were the papers presented. R. A. Work, irrigation engineer in charge of snow surveys, U.S. Soil Conservation Service, Medford, Ore., was author of the first, and B. E. Torpen, head engineer, U.S. Engineer Department, Portland, Ore., of the second.

Nearly 1,000 men were engaged in snow survey work for 170 cooperating agencies last winter, Mr. Work said, stressing the importance of this operation in forecasting stream flows in the arid mountain and Pacific Coast regions.

"They conducted nearly 2,300 separate surveys on 925 courses in 12 states and two Western Canadian Provinces," he said. "They used 185 shelter cabins scattered along 20,000 miles of winter ski trails in accomplishing this job. Their efforts are saving time, seed, and money, and sometimes preventing complete crop failures."

Mr. Torpen's paper dealt with the extensive studies of holdover storage and cited, as an example, that power yield from the Columbia River could be increased by a third if adequate storage capacity were available. Curves and charts he has prepared are expected to be of material assistance in selecting the best height of storage dams, not only along the Columbia River but on other waterways.

Holdover storage as advocated by Mr. Torpen would collect water during years of heavy runoff for use in years of deficient discharge. The only alternatives offered are: (*a*) limitation of power installations to a small percentage of potential; (*b*) development of steam plants for auxiliary power during periods of low discharge. As a striking example of the economies of holdover storage, his storage yield curve showed that with only 5% of a stream's runoff held in storage, potential firm power would be doubled.

Economics of the Highway Construction Program Examined at Spokane Session

ATOM bombs and other advances in scientific warfare make a strategic network of American military highways more important than ever, and an annual highway program of more than two billion dollars would be an essential stimulus to the nation's economy and a preventive for mass unemployment and depression.

Two papers at the Highway Division session developed these ideas. They were authored by John W. Wheeler, executive assistant to the president, Chicago, Burlington and Quincy Railroad who, as an Engineer Corps colonel, made a study of military highway transportation in World War II, and Charles Upham, engineer-director of the American Road Builders' Association, Washington, D.C. Day Okes, Highway Division Executive Committee chairman, presided at the session. Colonel William N. Carey, New York, Secretary and Executive Officer of ASCE, read the Wheeler paper in the unavoidable absence of the Chicagoan.

"Wide rights of way, wide shoulders, and easy sloping side ditches pay large dividends when highways are needed in combat," the Wheeler paper said. "The only logical manner for an aggressor nation to start world conquest would be to attack the United States first, thus avoiding the mistakes previous would-be conquerors made in permitting us late entry into the last two wars and time to prepare.

"One nation can destroy a city of another nation from the air, or with these modern instruments of destruction, but it cannot actually take over that city without placing there a soldier with a bayonet. This soldier with a bayonet—and I include with him tanks, artillery, and all the weapons of ground forces—is the one who actually prevents the raising of a foreign flag on our land, and these troops in mass and volume must be moved over land—on the rail and highway network."

Mr. Upham called on the 48 states to assure prosperity and, at the same time,

make up the "highway deficit" resulting from the depression and aggravated by the war, by making use of the $2,212,000,000 in federal aid and matching funds now available. He predicted that "there will be close to 40 million cars by 1950," warned that the number of automobile fatalities, which always has kept pace with the number of cars, will increase staggeringly from the 40,000 which occurred at the 1941 peak, when there were 34,460,000 registered motor vehicles, and urged that the new highways feature "built-in safety."

"During the twenties, full employment and prosperous conditions existed when construction volume exceeded 12% of the national income," Mr. Upham said. "Public construction should be adjusted to keep the total construction always above 12% of the national income. The highway dollar is an all-powerful economic weapon. For each dollar spent, three dollars worth of business results."

River Development Featured at Session of Waterways Division

MULTIPLE-PURPOSE development for most efficient and economic use of water in the Columbia River Basin was the topic which held the spotlight at the Waterways Division session.

Papers were prepared by Col. O. E. Walsh, Corps of Engineers, USA, District Engineer, Portland, Ore., on "Flood Control Problems in the Columbia River Basin"; Col. C. P. Hardy, Corps of Engineers, USA, District Engineer, Seattle, Wash., on "U.S. Engineer Department Review Report on the Columbia Basin"; and R. E. Hickson, head engineer, U.S. Engineer Department, Portland, Ore., whose subject was "Improvement of the Columbia River for Navigation."

"Active construction is under way on major authorized flood control projects," Colonel Walsh said. "A large number of smaller projects have been authorized, and reports on many areas which experience costly floods have been or are being submitted to Congress. This great and growing section, with a total drainage area of some 260,000 square miles, is receiving its full and proper consideration under our fine national flood control policy."

Colonel Hardy's paper, read by C. B. Lusk, engineer, Seattle Engineer District, Corps of Engineers, reported that field and office investigations of potential dam sites are a major part of the work now under way in a comprehensive study of the area.

"The investigations," the paper stated, "include consideration of more than 1,000 sites and detailed studies of those most promising. Reconnaissance investigations are well advanced in the river basin as a whole, and are completed on some of the tributaries. Each project is considered as a part of the comprehensive multiple-purpose development of the river basin, and the best plan for each tributary and the basin as a whole will be determined from economic, physical, and other standpoints."

Public benefits of more than four times the cost of making its turbulent waters navigable have been extracted from the Columbia River over the last twenty years, Mr. Hickson told the Waterways Division members who attended the session, at which Col. C. L. Hall, New York, chairman of the Division's Executive Committee, presided.

"Those costs," Mr. Hickson said, "were $21,374,000. Benefits to the public are very great and are sufficient to pay for the original cost every nine years. Movement of tonnage on the Upper Columbia has increased from about 38,000 tons annually at the time of completion of Bonneville Dam to the present total of 612,000 tons as far as The Dalles, and about 543,000 tons above that point.

"The Columbia River system of waterways constitutes one of the greatest assets of the Northwest. The region through which the rivers flow is as yet undeveloped, but the potentialities of the region for the development of great quantities of electric energy are tremendous, and will within a short time result in a great industrial development and increased movements of commerce."

Aerodynamics of Bridge Design Explained to Structural Division

FAILURE of the Tacoma Narrows Bridge on November 7, 1940, has spurred civil engineers on to studies that bid fair not only to make safe construction of another bridge there possible, but to provide knowledge highly useful in determining the degree of safety in other suspension structures throughout their lifetime.

This was the gist of papers presented before the Structural Division by three of several engineers who have accepted the challenge presented by the much-heralded bridge failure. They are Prof. F. B. Farquharson, professor of civil engineering, University of Washington, Seattle; C. E. Andrew, consulting engineer, Washington Toll Bridge Authority, Tacoma; and another Tacoman, Dexter R. Smith, the Toll Bridge Authority's designing engineer. John I. Parcel, St. Louis, member of the Structural Division's Executive Committee, presided.

Using charts and motion pictures, the three engineers illustrated how the principles of aircraft makers in decreasing wind resistance can be applied to suspension-bridge designing. The principle, they stated, is virtually identical, and their objective has been to eliminate wind pressure—cause of the failure—in the same way that the plane makers have done away with "wing flutter."

"Wing flutter is analogous in many ways to oscillation in a suspension bridge," Mr. Andrew said. "However, the type of air flow around a perfectly formed wing is entirely different from that to be expected around blunt or rectangular forms such as must be used in a practical bridge form."

With the help of models in a wind tunnel at the University of Washington, the engineers made studies which lead them to believe that a completely successful suspension bridge can be built across the Tacoma Narrows. The new bridge would have four traffic lanes, instead of two, and to offset wind pressure:

Plate-girder stiffening members would be excluded in favor of deep open trusses.

Open-trussed floor beams would be used instead of the conventional plate-girder type.

The frontal area would be reduced and broken into many small parts instead of one large commanding area, as in the former bridge, thus setting up a condition in which the aerodynamic forces would tend to fight or nullify one another, and at the same time reduce drag.

Utilization would be made of a new streamlined rail section the engineers have designed.

Open steel grid slots of varying widths would be left between each of the four traffic lanes and at the curb, thus permitting air to pass through vertically, just as the open rail section and the open trusses would permit horizontal air flow.

Preliminary plans call for utilization of parts of the former piers, anchorages, and approaches, which cost $3,000,000, the three engineers pointed out. They added that their model studies indicated that where the old bridge virtually "shook itself" to pieces, the new structure would have "an approximate total movement of six inches at the chords, which is considered of no importance, and one which is to be expected in any suspension bridge."

Their studies convince them, they said, that investigations of winds as they exist

may well become very important in the preliminary design studies of every suspension bridge, and will be a major consideration in determining the type of structure to be used.

"A full knowledge of the natural wind, such as maximum velocity, direction, both horizontal and vertical; the effect of terrain on angle of attack; probable duration of periods of nearly constant velocity, etc., all have a bearing on design and model tests," they said. "The sufficiency and safety of existing bridges cannot be judged unless considerable knowledge of the actual storms to which they have been exposed is at hand."

Hydraulics and Power Divisions Join to Study Reservoir Sedimentation

MEANS for removing sediment from storage reservoirs were proposed at a meeting of the Hydraulics and Power Divisions at which C. P. Vetter, Denver, chairman, Joint Committee on Sedimentation in Reservoirs, presided. Special attention was given to test methods that have proved valuable in determining the sediment load of streams and to the use of density currents to decrease sedimentation.

Following a general statement of the problems related to reservoir sedimentation by Carl B. Brown, of the Soil Conservation Service, Washington, D.C., successful removal methods were described by Hugh S. Bell, Pasadena, Calif., soil conservationist with the U.S. Department of Agriculture. Size and behavior of density currents at Lake Mead and at Elephant Butte Reservoir were described.

Devoting special attention to the development of operating techniques making effective use of density currents, Mr. Bell pointed out the dangers in postponing the removal of sediment by currents until some time after a reservoir is in operation. Need was indicated for the making of additional field and laboratory investigations.

Another paper, prepared by Martin E. Nelson, with the St. Paul U.S. Engineer office, and Paul C. Benedict, U.S. Geological Survey, Lincoln, Nebr., was presented, detailing a study of methods used in the measurement and analysis of sediment loads in streams. With numerous slides, sampling devices and their use were explained. The study has been a joint enterprise of the Bureau of Reclamation, Corps of Engineers, Geological Survey, Office of Indian Affairs, Soil Conservation Service, and the Tennessee Valley Authority and was carried on at the Hydraulics Laboratory of the State University of Iowa.

An additional feature of the session was a movie presented by Mr. Bell devoted to experiments on density currents conducted by the California Institute of Technology.

Meeting of Board of Direction—Secretary's Abstract, July 15, 16, 1946

THE BOARD of Direction held its summer meeting at the Hotel Davenport in Spokane, Wash., on July 15 and 16, 1946. It was called to order on July 15 at 10:00 a.m. by President Horner; and present also were Past-Presidents Stevens and Pirnie; Vice-Presidents Howard, Harrington, and McNew; Directors Bryan, Critchlow, Gamble, Gardiner, Glidden, Haertlein, Hardesty, Huie, Koch, Panhorst, Piatt, Saville, Shannon, Thomson, and Tipton.

Membership Grades

The Board decided that the question of membership grades and related matters is to be referred to the membership for questionnaire ballot. First, however, the subject is to be discussed at meetings of Local Sections called for that special purpose. From the results of the questionnaire the Board will decide with respect to any formal action looking toward constitutional amendments.

E.C.P.D. Representative

To fill the vacancy occasioned by the expiration of the term of Admiral R. E. Bakenhus as representative of the Society on Engineers Council for Professional Development, V. T. Boughton, M. ASCE, of New York, was appointed.

Nominee for Engineering Foundation

The Board nominated Dr. B. A. Bakhmeteff, Hon. M. ASCE, as Society member to serve on the Board of Engineering Foundation. Formal election is made by that board.

Wellington Prize

At the request of *Engineering News-Record*, donor of the Wellington Prize, this award was broadened in scope to include papers on foundations and closely related subjects, but not including contributions in the form of reports and manuals. That is, the prize is to be limited to individuals.

Boulder Dam

The Board registered its support of House Joint Resolution 346, now before Congress, proposing that the name of Boulder Dam be changed to the original name, "Hoover Dam."

Bloom Bill

After full discussion of House Resolution 4982, known as the Bloom Bill, the Board approved a recommendation of Engineers Joint Council to the effect that, while much of the bill deserved commendation and support, other features were highly detrimental to engineers and to the public interest. The Board approved an E.J.C.-sponsored statement outlining the objections of the engineering profession to this legislation.

Remedial Labor Legislation

The Board showed great interest in a statement prepared by the Secretary and Mr. Chandler and presented to a subcommittee of the House of Representatives in Washington on July 10 by the Society's Washington representative, as shown on page 339 of this issue. The statement was reviewed, vigorously commended, and adopted by the Board.

Publicizing E.J.C. Program

It was decided to give full support to a program of Engineers Joint Council for 1946–1947, toward further unification of the activities and aims of the engineering profession at national and local levels.

ASCE Recommends Boost in Salaries of Engineers

NEW salary recommendations calling for increases in all grades in the "Classification and Compensation Plan," adopted in 1944, were approved by the Board of Direction of ASCE at its meeting held in Spokane July 15 and 16, in conjunction with the annual summer Convention.

The increases range from 22% in the highest classification to 41%, and the new range of salaries for engineers extends from the $2,652 starting salary for Grade I to $12,000 and up per year for Grade IX.

Board of Direction action was on recommendation of its Committee on Salaries, of which E. B. Black, Kansas City, Past-President, is chairman, and Sterling S. Green, Los Angeles, is vice-chairman. Paul Weir, Atlanta, is the third member of the Committee.

Details of the recommendations will be published in CIVIL ENGINEERING for September.

Further details will be released as the plans are perfected.

Future Society Meetings

Favorable consideration was given to invitations for Society meetings to be held in Sacramento, Calif., in the spring of 1948, and in Boston, Mass., in the fall of that year. A Denver, Colo., invitation for the summer of 1952 also was placed on the record for later favorable consideration. The locations for the summer and fall meetings in 1947 were not selected. The Spring Meeting for 1947 has previously been announced for Phoenix, Ariz.

Salary Schedules

The Board approved a progress report from the Committee on Salaries suggesting interim changes in the rates of pay for the various grades of engineering services as adopted in July 1944. The changes constitute increases throughout the list, ranging from 22 to 41%. A separate item elsewhere in this issue gives further details.

Publication Department Changes

The Committee on Publications advised the Board of personnel changes to be made at the New York Headquarters regarding Society publications. The changes are indicated by new titles for present employees. These are:

Manager, Technical Publications—Sydney Wilmot
Editor, Technical Publications—Harold T. Larsen
Manager CIVIL ENGINEERING—C. E. Beam
Editor, CIVIL ENGINEERING—Allen Wagner
Assistant Editor, CIVIL ENGINEERING—Don P. Reynolds
Advertising Manager, CIVIL ENGINEERING—W. L. Glenzing

These announced changes were received favorably by the Board.

Secretary's Title Changeds

The Board voted that the Secretary of the Society should hereafter carry the title, "Executive Secretary" as a better description of his actual duties as prescribed in the By-Laws.

Vote of Thanks

In recognition of the splendid hospitality and local arrangements, a resolution of cordial appreciation was extended to the Spokane Section and to the Hotel Davenport.

Adjournment

The Board adjourned at 6:00 p.m. on July 16, to meet at the time of the Fall Meeting in Kansas City, Mo., in October.

Committee on Contracts Preparing Standard Forms

ACTIVE WORK on the compilation of basic data has been resumed by the Committee on Construction Contracts and Specifications of the Society's Construction Division, following the appointment of Prof. R. B. Wiley to succeed Frank M. Masters, the Committee's first chairman, who asked to be relieved of the chairman's duties because of other demands upon his time. Mr. Masters will continue to serve as a member of the Committee.

Created by action of the Board of Direction in July 1945, the Committee received a directive to develop standard forms of construction contracts, compile standard definitions of contract terms, and promote the preparation of contract documents and specifications for construction work, with particular emphasis on clarity, fairness, and uniformity. It was felt that standard forms would be a valuable guide to engineers in drafting contract documents for specific projects.

R. B. WILEY, CHAIRMAN OF COMMITTEE ON CONSTRUCTION CONTRACTS AND SPECIFICATIONS

Professor Wiley, head of the School of Civil Engineering and Engineering Mechanics, Purdue University, has had twenty years' experience in the writing and teaching of construction contracts and specifications. His knowledge and ability will be of great value to the Committee in organizing and directing its work. Mr. Masters, by remaining as a member of the Committee, will assist the new chairman in maintaining continuity of the Committee's activities.

In making its preliminary studies, the Committee welcomes suggestions from ASCE members and from others who are interested in construction contracts and specifications. The Committee is particularly eager to receive copies of all standard forms of contracts and specifications which have been developed in any part of the United States or its territories. These documents will be highly useful to the Committee in carrying out its purpose of preparing standard forms to be submitted to the Board for possible adoption and publication by the Society.

At present, the Committee consists of six members. In addition to Professor Wiley and Mr. Masters, they are: Robert W. Abbett, Verne L. Peugh, Eugene W. Robinson, and James H. Stone. This membership includes representation of government, industry, and engineers in private practice, as recommended by the Board of Direction in authorizing the Committee.

Copies of "Transactions" Vol. 105 Urgently Needed

AMONG the back numbers of Society publications most in demand is Volume 105 (1940) of TRANSACTIONS. Stocks of this volume have been completely exhausted so that it is impossible to supply veterans who were unable to receive their copies during the war, or members in foreign countries who were in inactive status during the war period. Another demand that cannot be met is that of foreign libraries.

Wherever duplicate copies are available or where other circumstances permit, it would be appreciated if copies of this volume could be returned to ASCE Headquarters, 33 West 39th Street, New York 18, N.Y., for redistribution where needed.

Student Prizes Resumed by Maryland Section

WITH the resumption of peacetime activities, the Board of Direction of the Maryland Section has authorized the reestablishment of Student Chapter prizes. The prizes, totaling not more than $40, are to be divided equally between the Chapters at the University of Maryland and Johns Hopkins University.

First prize, at each school, will consist of payment of the recipient's Junior membership dues in the Society for the first year. These awards will be made solely on the basis of highest scholastic standing. Also at each school a more personal prize (such as a wallet or fountain pen), costing not more than $10, is to be awarded for the best technical paper or in some other form of competition, which may be suggested by the Local Committee on Junior and Student Affairs.

Five Prizes Proposed for Research Programs

THE COMMITTEE on Research, one of the committees advisory to the Society's Board of Direction, finds that there is a great need for stimulating imaginative thinking with respect to research projects of a truly fundamental character in civil engineering fields. In canvassing suggestions for research projects that have come before it, the Committee is impressed with the lack of adequate concepts of fundamental research, and the tendency to confuse what are in effect large-scale testing projects with basic research designed to apply fundamental scientific and engineering knowledge to the discovery of new or improved procedures, techniques, inventions, practices, methods, or materials.

To assist in arousing a greater interest in fundamental research and to aid the Committee on Research in securing grants and cooperative effort in aid of such research, the Committee recommends that a prize of $100, accompanied by an appropriate certificate, be awarded annually for the most meritorious research project submitted by a member of the Society and approved by any one of the several Divisions of the Society.

The prizes shall be known as the Research Program Prizes of the ASCE. The Committee on Research suggests the following rules to govern the award of these prizes:

A. Research projects submitted for the prizes shall be channeled through the executive committee of any appropriate Division of the Society. The executive committee of any Division may transmit in any one year to the Committee on Research not more than three projects which it considers most satisfactory.

B. The Committee on Research shall consider research projects approved by any Division executive committee. It may award a prize of $100 to the author of the best project coming from any Division. Not more than one prize shall be awarded through a given Division, and there is no obligation of the Committee on Research to award any prize unless the project is, in its judgment, worthy of such award.

The maximum number of prizes to be awarded annually shall not exceed five.

C. In presenting research projects for consideration for the awards, the following principles shall govern:

1. The project shall be of a fundamental character.
2. The need and objectives of the research shall be fully set forth.
3. The proposed project shall be fully outlined, indicating methods to be followed, the staff and equipment required, and a rough estimate of the cost time for completion.

The Committee on Research hopes that wide publicity may be given to these prizes, to the end that numbers of well-conceived research projects may be submitted through the Divisions of the Society, which will prove worthy of endorsement by the Committee on Research.

The Committee will assist in securing means to carry out any project that it endorses, whether or not such a project is one for which a prize is awarded.

J.C. Hoyt, Former ASCE Vice-President, Is Dead

MEMBERS of the Society will be saddened to hear of the death of John C. Hoyt, former Director and Vice-President, which occurred at his summer home in Paris, Va., on June 21, 1946. Mr. Hoyt, who was 72, was with the U.S. Geological Survey for more than 40 years.

Born in Lafayette, N.Y., he was graduated from Cornell University in 1897 as a civil engineer. Following his graduation, Mr. Hoyt entered government service with a position in the Navy Department. Two years later he moved to Washington, D.C., where he lived until his retirement in June 1944. In 1902 he joined the Water Research Branch of the U.S. Geological Survey, and was put in charge of the computing section. In 1907 he was designated assistant chief hydrographer, and in 1911 became chief of the Surface Water Division, holding the latter position until 1930. From 1931 until his retirement he served as consulting engineer for the Survey, concentrating on technical rather than administrative aspects of the work. It was during this period that he wrote two well-known articles on droughts—"Droughts of 1930–1931" and "Drought of 1936, with Discussion of Significance of Drought in Relation to Climate."

JOHN C. HOYT, 1874–1946
Former Director and Vice-President

During the period from 1904 to 1930, when Mr. Hoyt was most closely concerned with administrative problems of the Branch, he visited district offices of the Survey in almost every state and every important gaging station. He was known in Alaska and Hawaii too, having inaugurated the stream-gaging program in Alaska in 1906 and visited Hawaii.

He was an official government representative to the World Power Congress in London in 1924, as well as delegate to the World Navigation Congress in Cairo in 1926 and to the World Engineering Congress in Tokyo in 1929.

Long a member of the Society, Mr. Hoyt served as Director from 1920 to 1922 and as Vice-President 1927–1928.

"Civil Engineering" Trim Size Again Reduced

PAPER shortages have again caught up with the publication business and have obliged the Society, among others, to make further economies. Starting with the July issue, the trim size of CIVIL ENGINEERING was again reduced. The new size is but slightly larger than the war size; it is now $8\frac{1}{4}$ by $11\frac{1}{4}$ in.

It is realized that the resulting change is somewhat of a hardship, especially to those who are in the habit of preserving and filing, or binding, their yearly issues. In this connection, it should be remembered that the Society was loath to make the change but felt obliged to maintain harmony with other publishers and advertisers.

It is one consolation to realize that as soon as it is feasible the Society expects to return to the normal trim size.

Canal Zone Stamp Honors John F. Stevens

A NEW five-cent Canal Zone stamp honors John F. Stevens, both a Past-President and an Honorary Member of ASCE, who is well known as the Chief Engineer of the Isthmian Canal Commission during the critical early period (1905–1907) of organizing and starting the work on the Panama Canal. He is also well known as a railroad engineer.

Following his work on the Canal he became vice-president of the New York, New Haven and Hartford, in charge of operations. For 6 years he had his own consulting practice in New York, then was sent to Russia in 1917 as chairman of a commission of railroad engineers and for the next 6 years was president of the Inter-Allied Technical Board. In 1923 he returned to this country and retired from active life. In 1927 he served as Preident of ASCE. He died on June 2, 1943.

News of Local Sections

Recent Activities

Central Illinois Section

Speaking before a recent joint meeting of the Section and the University of Illinois Student Chapter, Walter B. Robey described the construction of the Topock Bridge over the Colorado River on the Atchison, Topeka and Santa Fe Railroad. Mr. Robey, who is on the engineering staff of the railroad, supplemented his talk with a film showing the sinking of the piers and the erection of the superstructure. A feature of the occasion was the presentation of Section prizes of Junior membership in the Society to outstanding University of Illinois engineering graduates. Recipients were two civil engineering students—Dalton Hoskins and Donald Henry Swets—and one general engineering student, Barbara Lee Crawford. It was also announced that the Illinois Section award goes to Thomas D. Wafford, a member of the University of Illinois Chapter. At another meeting Col. Clark Kittrell, division engineer for the Mississippi Valley Division of the U.S. Engineer Office, explained in detail the War Department's plan for flood control on the Illinois River and its tributaries.

Connecticut Section

The work of the research and planning division of the Connecticut Development Commission was outlined by Elmer R. Coburn, director of the division, at a recent meeting. The division seeks to promote the economic and general development of the state by enlisting the cooperation of various groups within the state and by making active efforts to secure new industries for it. Mr. Coburn's talk was illustrated by samples of the publicity issued by the State Development Commission and of the material being used by other states in similar campaigns. During the evening it was announced that the Connecticut Section's prize of Junior membership in the Society has been awarded to William Alvin Sorensen, of Yale University.

District of Columbia Section

An excursion and picnic supper were features of the June 25 meeting, at which members of the Maryland Section were specially invited guests. Hosts to the joint meeting were the officers and men of the Naval Ordnance Laboratory at White Oak, Md. About 325 engineers made the tour of the 20-million-dollar project, which is in the construction phase. In addition to several types of laboratory building, the visitors were shown parts of a captured German supersonic wind tunnel, which will be assembled at the laboratory. Of a design said to be in advance of any similar facility in this country, the tunnel will create wind blasts of 2,500 miles per hour. The magnetic buildings were one of the main points of interest. Because of the research on magnetic mines which is to be done in the buildings, they had to be constructed entirely of nonmagnetic materials. A program of speakers, movies, and entertainment—arranged by President Frank Weaver and Harold Marsh, chairman of arrangements—topped off a full evening.

Florida Section

Model and prototype studies and their value in solving waterway problems were discussed at the June meeting by H. B. Simmons, of the U.S. Waterways Experiment Station at Vicksburg. Of particular interest to the members were the studies of the Savannah River in Georgia and the St. Johns River in Florida. Model studies of the former enabled the elimination of several sharp bends in the Intercoastal Waterway by the cutting of a 100-ft channel at a point to conform with the location on the model. The St. Johns River model was constructed to determine the effects of a proposed cutoff channel between Dames Point and Fulton, but the solution to that problem has not yet been completed. Since the St. Johns River model study included the port of Jacksonville and proposed improvements to the harbor, the mayor and representatives of the Chamber of Commerce and numerous civic groups attended the meeting.

Indiana Section

A joint dinner with the Indiana Society of Professional Engineers comprised the June meeting. Since the gathering had been arranged to promote good fellowship among Indiana engineers, both societies dispensed with business sessions. Following dinner and a social hour, Wilbur Shaw gave a talk entitled "The Saga of the Indianapolis Speedway." Mr. Shaw is president and general manager of the Indianapolis Motor Speedway.

Ithaca Section

At a recent meeting the Section was host to the Cornell University civil engineering graduates at a dinner on the Cornell campus. The scheduled speaker was Prof. C. E. O'Rourke, who discussed "Design Features of Suspension Bridges," giving a historical account of the development of stiffening trusses. The showing of a film on the building of the Golden Gate Bridge, which had been loaned by the Bethlehem Steel Company, completed the technical program. On another occasion William L. Havens, Cleveland consultant, read a paper on "Water Supply Needs of Metropolitan Cleveland."

Kentucky Section

With Society President W. W. Horner as guest and principal speaker, the Section held a recent joint meeting with the Student Chapters at the University of Kentucky and the University of Louisville. R. G. Turner, president of the University of Kentucky Chapter, acted as toastmaster and presided at a speaking contest. After hearing the six contestants, whose talks covered a wide range of subjects, the judges awarded the first prize of $15 to A. E. Green, of the University of Kentucky, for his talk on "The Future Responsibilities of the Engineer"; the second prize of $10 to T. C. Graham, of the University of Louisville, for his treatment of "Louisville's Traffic Problem"; and a third prize of $5 to R. C. Wenzel, of the University of Louisville, whose subject was "The Postwar Parking Problem." The annual Section awards of Junior membership in the Society for the outstanding graduate from each school went to Marion C. Welch, of the University of Louisville, and G. R. Turner, of the University of Kentucky. At the conclusion of the student program Mr. Horner spoke on the professional activities of the Society.

Los Angeles Section

The annual joint meeting with the California Institute of Technology Student Chapter attracted an overflow attendance this year. Dr. Lewis J. Dunn, associate professor of aeronautics and assistant director of the Jet Propulsion Laboratory at the Institute, gave an illustrated talk on various jet-propulsion devices as applied to aircraft. Also of interest was the showing of a captured German film depicting the launching of the V-2 aerial bombs.

The incineration of municipal waste was discussed by L. A. Cline, general manager of the Disposal Engineering Company, at a recent meeting of the Junior Forum. The incineration of garbage has made great strides since the first World War, Mr. Cline pointed out, and the modern incinerator, handling mixed garbage and rubbish with a maximum moisture content of 70% water, now gives very little trouble. According to Mr. Cline, one of the greatest advantages of this method of garbage disposal is the destruction of parasites and other disease vectors transmitted by garbage and garbage-fed hogs.

Louisiana Section

At a recent meeting, E. S. Pennebaker explained why the port of New Orleans

needs a tidewater ship channel and modern mechanized export and import terminal wharves on tidewater. Much of the meeting was devoted to discussion of pending state legislation intended to weaken the Civil Engineer Licensing Law. The Section is taking action to combat the proposed legislation and to organize the profession in opposition to it.

MARYLAND SECTION

Members of the Maryland Section were guests of the District of Columbia Section for the excursion to the Naval Ordnance Laboratory at White Oak, Md., and the picnic supper, reported under the head of the District of Columbia Section elsewhere in this department. The Maryland delegation, consisting of about thirty-five members, commandeered a bus and their own *Baltimore Sun* reporter for the occasion.

MONTANA SECTION

"Shall we attempt this year to obtain enactment of an engineers' license law for Montana?" members of the Section asked themselves at a recent meeting. Participants in the discussion included R. A. Stephenson, J. H. Morrison, and H. C. Helland. It was the consensus of opinion that such a law would benefit the qualified engineers of the state, and the president appointed a committee to poll the membership of the Section preparatory to initiating legislative action. Montana is the only state having no engineers' license law, it was pointed out.

NEW MEXICO SECTION

An inspection tour of the construction of the Conchas and Hudson canals in the vicinity of Tucumcari, N.Mex., initiated the two-day convention of the New Mexico Section, which was held in June. The U.S. Bureau of Reclamation was in charge of the trip. Outstanding features viewed were several reinforced concrete inverted siphons, one extending under the outskirts of Tucumcari, and a reach of canal being made high above the valley floor between fills of earth compacted to a density of 140 lb per cu ft. The principal speaker at the dinner that evening was Wesley R. Nelson, regional director for Region 5 of the U.S. Bureau of Reclamation, who discussed the Tucumcari Project and the activities of the Bureau of Reclamation in general. Guests included Society Vice-President J. T. L. McNew; Society Director Oscar Koch; and Harold W. Mutch, Murel M. Starr, and Leo F. Carden, all of the U.S. Bureau of Reclamation staff. All spoke briefly. The program the next day consisted of a trip starting at Tucumcari and leading up the main canal system to Conchas Dam. The group was conducted about the dam by members of the U.S. Corps of Engineers. Structures viewed included long tunnels, sluicing systems, and two gaging stations. A picnic lunch on the banks of Conchas Lake brought the convention to a pleasant close.

NEW MEXICO SECTION VISITS TUCUMCARI PROJECT
Inspecting Check and Wasteway, Conchas Canal, Just Above Siphon No. 24

EXECUTIVE COMMITTEE OF THE NEW MEXICO SECTION
Left to Right: D. C. Bondurant, Past-President; W. C. Bratchi, President; and R. E. Cook, Secretary-Treasurer

PHILADELPHIA SECTION

With the war over, the Philadelphia Section has reverted to its custom of holding an outing to mark the close of its year. The outing took place at the Bala Country Club, where some of the members played golf prior to a cocktail party and dinner. The attendance of 150 included the wives of members. Francis S. Friel, the retiring president, reported a successful year and turned the meeting over to Lester L. Lessig, the new president. Lyle Jenne was master of ceremonies for an excellent entertainment. The entertainers had to share their applause however with Mr. Friel, when he announced that "this dinner is free, a present from the Section."

PUERTO RICO SECTION

Army films showing the operation and care of earth-moving equipment were presented at the June meeting of the Section, which was sponsored by local representatives of Le Tourneau Company. Lee Jorgenson gave a supplementary talk and led a general discussion on the use of earth-moving equipment.

ROCHESTER SECTION

Guest of honor and principal speaker at the last meeting of the season was Arthur W. Harrington, district engineer for the U.S. Geological Survey at Albany, N.Y. As Vice-President of the Society from Zone I, Mr. Harrington reported on the Spring Meeting and discussed the organizational set-up of the Society, commenting particularly on the functioning of the various units and on current interests and trends. Part of the meeting was devoted to business discussion.

SACRAMENTO SECTION

At one of the June luncheon meetings members of the Sacramento Section heard André Bulloche, a French engineer visiting the United States, describe his wartime activities in the French under-

ground and his experiences in a German concentration camp. Mr. Bulloche also described the engineering problems now facing France. There is need for much engineering work because of the destruction during the war, he stated, but materials are virtually unobtainable. Speakers at the other luncheon meetings were Stanton Walker, of the National Sand and Gravel Association; Frank P. Barnes, of the General Electric Company; and Glenn Hall, city planning engineer of Sacramento.

San Diego Section

The showing of official sound pictures made by the Eleventh Naval District comprised the technical program at the Section's last meeting of the season. The films were entitled "Fury in the Pacific" and "The Shores of Iwo Jima." Commander McFadden, of the Construction Battalions, then described the role of the Seabees in the engagements depicted and discussed his own experiences.

San Francisco Section

The subject, "Direct Measurement of Stress in Structures," was presented by Roy W. Carlson at a recent well-attended meeting of the Section. Mr. Carlson is research engineer at the Engineering Materials Laboratory of the University of California.

Syracuse Section

New officers were elected at the recent annual meeting of the Syracuse Section. They are Theodore W. Hunt, president; Donald E. Stearns, vice-president; and J. O. Eichler, secretary-treasurer. Following the business session, Dr. Earl T. Apfel, of the geology department at Syracuse University, spoke on the subject, "The Witch Stick or Divining Rod." A report on the Local Section Conference, held at the time of the Spring Meeting, concluded the program. This was given by Mr. Eichler.

Tacoma Section

Guest of honor and principal speaker at a recent dinner meeting was Ole Singstad, New York consultant. In his talk on tunnel construction, Mr. Singstad discussed some of the problems encountered in tunnel driving, describing the details of tunnel "blow-ups" through river bottoms. Another problem to be faced, he pointed out, is the prevention of the "bends" among the working men. Despite all the precautions taken, Mr. Singstad stated, this disease is still responsible for a number of casualties. His talk was illustrated with slides of several tunnel projects in New York.

Tennessee Valley Section

The all-day spring meeting of the Section, which was held at Fontana Dam, proved a great success, despite frequent heavy showers. In the morning guides were provided for a tour of the dam, powerhouse, and Welch Cove, the construction village near the dam. The formal meeting began with a luncheon, at which W. F. Moehlman welcomed the members and their guests. For the men, the afternoon started off with a brief business meeting, followed by a talk by O. H. Graves, head of the Site Planning Section, Regional Studies Department of TVA. Mr. Graves reviewed current plans to make Fontana Dam a recreation center for the Great Smoky Mountains Park. Carrying out the theme of Fontana as a recreation spot, Frederick Crone then spoke on "Recreational Roads." Mr. Crone is resident engineer for the Public Roads Administration. The ladies, in the meantime, were taken through some of the houses in Welch Cove, and later were entertained at bridge. Both groups met in the evening for a turkey dinner, after which Arthur Stupka, naturalist for the Great Smoky Mountains Park, gave an illustrated lecture on the park. The meeting adjourned on a note of praise for George Paolo and his committee on arrangements and for J. H. McKamey, acting project manager at Fontana Dam.

West Virginia Section

The Kanawha County (West Virginia) airport project, now under construction, involves the moving of millions of cubic yards of earth to make fills as deep as 209 ft, Fred Alley, director of the project, stated in a talk before the spring meeting of the Section. When completed, the airport will serve five interstate lines in addition to many local lines. Following Mr. Alley's talk, the entire group was taken on a tour of the project. In the evening there was a dinner, at which Past-President Ezra B. Whitman was guest of honor and principal speaker. Mr. Whitman discussed airports in general, stressing the fact that all progressive cities will provide airport facilities if they wish to keep pace with the development of the country. The meeting took place in Charleston on June 28, having been postponed for a month because of the railroad strike.

Members of the West Virginia Section Dine at the Daniel Boone Hotel

Left to Right: J. G. Henderson, Past-President, Charleston Chapter, W. Va. Soc. Prof. Engrs.; Ross B. Johnston, State Sec'y, W. Va. Soc. Prof. Engrs.; George W. McAlpin, Pres., Charleston Chapter, W. Va. Soc. Prof. Engrs.; E. B. Whitman, Past-Pres., ASCE; R. N. Shepard, Pres., W. Va. Section; Fred Alley, Director, Kanawha County Airport; J. N. Wallace, Sec'y, W. Va. Section; M. L. O'Neale, Past-Pres., W. Va. Soc. Prof. Engrs.

Wisconsin Section

The annual Juniors' Night was celebrated in Milwaukee on June 27. A pleasant feature of the dinner preceding the meeting was the round of cocktails served through the courtesy of two anonymous members of the Section. The principal speaker was a Junior, Edwin J. Duszynski, who gave an illustrated talk on underpinning Milwaukee's Safety Building. As building inspector for the city of Milwaukee, Mr. Duszynski participated in the planning of the work as well as in its execution. Outlining the details of the pre-test load method employed in the underpinning, Mr. Duszynski stated that it was the first application of that method of underpinning structures to be accomplished in the Milwaukee area. Following a general discussion, a special guest—John Potts, president of the Engineers' Society of Milwaukee—was introduced and spoke briefly of plans for a housewarming to mark the opening of the new engineering societies' building.

ITEMS OF INTEREST

About Engineers and Engineering

Contractors See No Drop in Construction Costs

"THERE is nothing to indicate that the cost of construction will be materially less any time during the next five years," said Oscar Coblentz, president of the McLean Contracting Company. As a part of a symposium on construction costs, Mr. Coblentz addressed the Maryland Section, ASCE, recently. "This period is one that will test the judgment of the owner, the skill and knowledge of the architect and engineer, and the courage and resourcefulness of the contractor," he continued. "During this period, and any other period for that matter, the lowest construction costs will be obtained through coordination of the efforts of all three parties."

Several other contractors spoke at the meeting. Included were William B. Spencer, M. ASCE, of the Consolidated Engineering Company, Inc.; Harold J. Dudley, M. ASCE, general contractor; and J. D. Tuller of the Tuller Construction Company. All speakers agreed that unusually high costs of materials and labor were responsible for abnormal building prices and that there is no reason to believe that either of these costs will be reduced materially during any foreseeable period.

Citing labor cost increases, Mr. Coblentz stated, "Labor costs, on an average, are more than 30% higher than the rates paid for the same classifications of labor in 1940. In some locations and under certain conditions labor is less efficient now, even at the higher rates of pay, than it was in 1940. In fairness to labor, the experience of our company does not indicate any appreciable decrease in efficiency of skilled labor. So-called common labor is scarce and is less efficient than it was four or five years ago.

"The inability to obtain the delivery of materials, when and as required, is a contributing factor in the decrease in labor efficiency. It is unreasonable to expect men working on a job to use up available materials and then be laid off for brief periods waiting for material to continue the job. With the increase in the rates of pay, it is increasingly important to plan construction operations so that the material will be delivered to the job, and workmen will have no excuse for not performing a reasonable day's work. It is my considered opinion that the decrease in efficiency in a construction operation is caused by the difficulty in obtaining materials rather than because of lack of efficiency or interest on the part of the workmen."

Materials were also discussed by Mr. Coblentz, who said, "The prices of materials have increased anywhere from 10% to more than 100% above prices paid for similar materials in 1940. The increase in the cost of basic materials now in effect, and the increase that is in prospect within the next ninety days, indicates that material prices for heavy engineering work, on an average, are about 25% to 30% above the 1940 costs of the same materials."

Other factors contributing to higher costs, according to Mr. Coblentz, are equipment maintenance, insurance, and general accounts.

"From this overall picture it is clear that the cost of performing a heavy engineering job is at least one-third more than the cost of performing similar work in 1940. This increase can be raised to as much as 50% above 1940 costs by arbitrary and impractical contract and specification provisions. The estimated increases in costs, hereinbefore outlined, represent the minimum increases in cost in a well-managed and well-planned job, performed with close cooperation between the owner, the engineer or architect, and the contractor," he continued.

ENGINEERS' COOPERATION NEEDED

"Close cooperation and coordination between the contractor, the engineer or architect, and the owner are essential. The engineer and architect can obtain the lowest costs by taking into consideration the materials that are available in the locality at reasonable costs, and designing and specifying the use of such materials. Where the plans and specifications are already prepared, the same results can be accomplished by providing in the contract and/or specifications for the substitution of materials, for those specified, that are available and will meet the engineering requirements of the job, and by setting up a method of assuring prompt approval of such substitutions, and a method of arriving at a reasonable and equitable adjustment in the contract price. Delays in making engineering and practical decisions, which are necessary on any job at any time and are essential under present conditions and under conditions that are likely to continue for the next five years, add greatly to the cost of performing the work."

Later in the program J. D. Tuller expressed the belief that wages will continue high because of the demand and supply factors. "The large pent-up demand for housing, which will continue for several years, is capable of absorbing almost all the present supply of mechanics in the building trades," he said. "The fact that no new mechanics have been made to any substantial extent during the last fifteen years has created a serious shortage. This shortage cannot be alleviated quickly. There is also a large backlog of construction work other than housing. It seems fairly obvious that the demand for labor will exceed the supply for a considerable period of time, especially with reference to construction labor.

"It is not politically feasible to reduce rates of wages even in times of depression. Our economics are now tied up to politics. Judging by our experience in the depression of 1930 to 1936, if there is another depression there will be a movement to 'spread the work' without reducing the rates of pay. The unions are now very strong. They are adamant in their opposition to wage decreases. From their standpoint, wages must always go up but never reverse the direction.

"The long-term trend of both wages and prices has been upward. This was true even before the present era of social legislation. The latter would appear to have the effect of accelerating this trend. High prices are inherent in large-scale spending, subsidies, unbalanced budgets, and other inflationary factors which, it appears, will be with us for some time to come."

Norman D. Kenney, President of the Maryland Section, presided over the symposium, which stimulated extensive discussion at the meeting in Baltimore.

How Broad Gaged Are Engineers?

"GOOD leadership was never at as high a premium as now," W. Walter Williams apprised the ASCE Convention at Spokane. Mr. Williams, who is president of Continental, Inc., in his address called upon civil engineers to assume badly needed leadership in community, national, and international affairs. Responsibility for intelligent leadership devolves upon engineers because of their traditional concern for the "application of technological discoveries for human benefits" and their "trained, accurate minds, and their ability to plan, then construct."

Continuing, Mr. Williams inquired:

"Is it fair to ask whether there may be a deficiency in the kind of leadership engineers might give? Are engineers so engrossed with the performance of their traditional technical jobs that they fail to possess the breadth of vision in the field of human relations and a depth of compassion and understanding of the needs of humanity to qualify them as the great leaders so sorely needed today? How broad gaged are engineers anyway? Let us ask a series of questions and you be your own judges.

"Do you vote regularly at every election? Unless you do you are not entitled to the rich benefits which derive from our American system.

"Do you make yourself a committee of one to see to it that members of clubs or other organizations to which you belong are registered and vote? If you don't, why don't you? Remember, those who would supplant our American form of government and our private-enterprise system are doing exactly that within their spheres of influence.

"Have you ever run for public office? Have you ever used your time, money, and effort to help get men of good caliber to run for public office and to get them elected? Remember, those who would remake Amer-

ica are spending every wakeful moment promoting their candidates.

"Do you, in your society meetings, devote periodic programs to the discussion of topics such as: (1) your local tax structure; (2) proposed community improvements; (3) city budget; (4) measures and candidates to be voted upon? Or do you study at your group sessions such topics as (1) inflation; (2) the Baruch Report on the control of the atom bomb; (3) the structure and progress of the United Nations?

"Do you participate actively in and support the program of your Municipal League, or whatever you may call the good government organization in your community? Or do you have such an organization? If you do not, why don't you start one?

"Do you belong to a church? Do you attend regularly? Would you like to live in a community without churches? It is not important what brand of church you desire to support, but support some church and support it actively. The world needs greater expression of unselfishness, tolerance, sympathy, understanding, and other attributes which are the essence of religion."

Electric Strain Gages Analyze Stresses in Welded Trusses

TO SECURE fundamental research data for the further development of welded H-section trusses of long span and unusual framing, the Austin Company recently concluded a series of tests that revealed in detail how the stresses flow through truss joints of this type. The trusses are fabricated completely from rolled members, which are simply cut to the desired length and assembled with their webs in a single vertical plane.

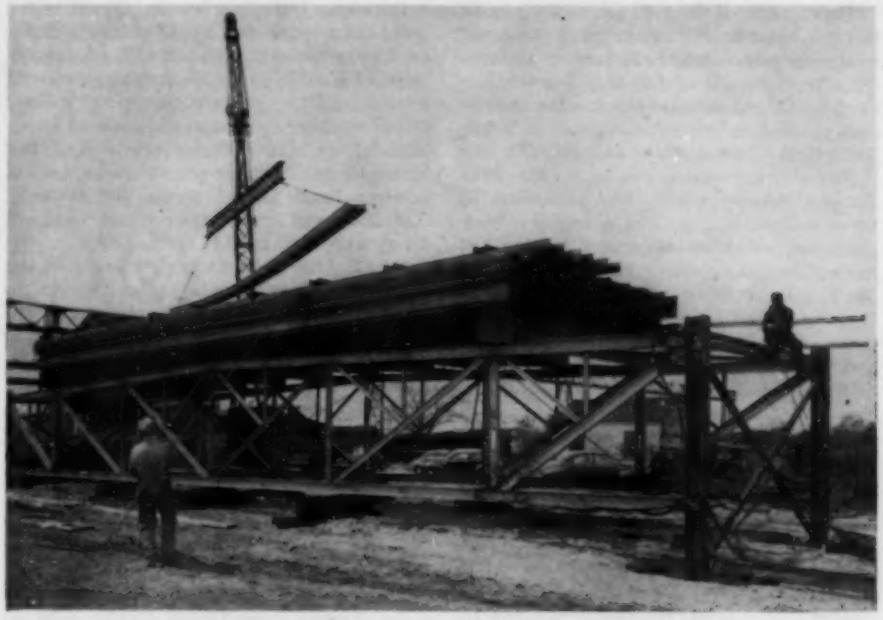
A total of 144 strain gages were used in the tests, which were conducted on a pair of 80-ft standard trusses taken from the stock on hand at the Austin fabricating shop in Cleveland. H. D. Churchill, professor of engineering mechanics at Case School of Applied Science, directed the tests, which were carried out by members of his staff.

At both ends of the first diagonal and at certain other important points, SR-4 strain gages were attached to the joints. They were placed at the same locations on both trusses to provide a check. The strain gages, made by the Baldwin Locomotive Works, make it possible to measure instantly the average strain in a $^1/_2$-in. length to one-millionth of an inch.

The gage itself consists of a tiny loop of copper-nickel wire with a diameter of one-thousandth of an inch—finer than a human hair. This is cemented to the steel surface so that it will change in length exactly as does the steel on which it is mounted. This stretching causes the diameter to decrease, and the change in diameter changes the resistance. While this change in resistance is extremely small, it is multiplied by electronic equipment to a point such that it can be measured by conventional recording devices.

LOADED WITH STEEL

Test loads were applied by placing 60-ft lengths of structural steel on the trusses in a manner which concentrated the full load on purlins located directly above the vertical truss members. The strain measurements were recorded by three automatic switching units and three SR-4 strain recorders made by the Foxboro Company and rented from Baldwin Southwark. Each pair of instruments, including a switching unit plus a recorder, made an automatic written record of the strains at 48 gage points, so that 144 individual strain readings could be recorded in about two minutes. More than three miles of wire were required to connect the gages to these instruments.



WELDED TRUSSES TESTED UNDER LOAD
Stresses Were Measured with Electric Strain Gages

The first test was made under a load somewhat over the design load, after which the entire load was removed. In the second test the following day, the trusses were loaded to a total of 254,000 lb, which was the equivalent of dead load represented by a cement-tile roof deck plus twice the live load, figured at 35 lb per sq ft. The maximum deflection with this peak load in place was about 2 in.

After the peak load had been reduced to 196,000 lb, this load was left on the trusses for three days over a week end, and the test was then completed. After removal of the total live load, both trusses showed a maximum residual deflection of $^1/_{16}$ in. Approximately 3,000 strain readings were recorded at intervals during the loading and unloading in the tests, as well as under the peak loads.

N. G. Neare's Column

Conducted by

R. ROBINSON ROWE, M. ASCE

JOE KERR, who seldom speaks until spoken to, surprised the August meeting of the Engineers Club by rising to a question of personal privilege. "Professor Neare," he alleged, "gave us a problem requiring the trial of 205 combinations to solve an indeterminate equation. I need another month."

"Adam Goodby's house problem does lead to indeterminates," admitted the Professor, "but Joe will have to prove the rest of his allegation."

"Well," began Joe, "I let x be a side of the garage, so its volume was $^1/_2x^3$ and cost $5x^3$. That made the house volume $4x^3$ and cost $80x^3$. Letting y be the side of the lot, the problem reduces to

$$50y^3 + 85x^3 = c^3$$

Obviously 5 is a factor of c, so I made $c = 5d$ and reduced to

$$10y^3 + 17x^3 = 5d^3$$

For the same reason, I made $x = 5z$, reducing to

$$d^3 - 2y^3 = 425z^3. \quad . \quad . \quad . \quad . \quad (1)$$

"Now the area of the lot was so limited that $105 < y < 147$, leaving 41 values to try. Also x was less than $y/3$ to get the buildings on the lot and more than 19 to store the car, which means $4 < z < 10$. With 5 values of z, there are 205 combinations to try. I've tried 50 so far; it's slow work."

"I can save him some work," offered Cal Klater. "Not so obvious but just as sure are the factors 5 in d and y. Setting $d = 5a$ and $y = 5b$, (1) becomes

$$a^3 - 2b^3 = 17z^3 \quad . \quad . \quad . \quad . \quad (2)$$

where $21 < b < 30$ and there are only 40 combinations to try. This can be reduced to 8 by the theory of quadratic residues, which limits z to one value, 7, in its bracket. Then it is simple to find $a = 83$ and $b = 23$—so the lot was 115 by 115."

"Nice work, Cal, but perhaps quadratic residues should be explained. Equations of the form

$$p^3 - eq^3 = m_1m_2m_3 \ldots .$$

where p, q and the factors m are relatively prime, can be solved in integers when and only when there are perfect squares of the form $e + fm$ for each factor m, that is, when e is a quadratic residue of each m. For $e = 2$, the smallest m's are 7, 17, 23, and 31.

"In (1), $425 = 17 \times 5^2$; since m can be 17 but not 5, we know that p, q and 5 are not relatively prime, which deduction leads to (2). In either (1) or (2), only 7 lies in the range 4–10 and satisfies the residue test, so that the final equation becomes $a^2 - 2b^2 = 5{,}831$ with b limited to the range 22–29.

"Here's an easier teaser. The Atta Buoy Company makes life preservers in three models, *F*, *O*, and *S*, of equal volume and cost, of equal buoyancy for certain waters, and alike except for the number of the 27 cells stuffed with each of three stuffings *A*, *B*, and *C*. Of these, *B* and *C* are twice and thrice as heavy as *A* and cost $^1/_2$ and $^1/_3$ as much per pound, respectively.

"In model *F*, for fresh-water craft, where $w = 62.4$, the numbers of cells filled with *A*, *B*, and *C* are respectively *a*, *b*, and *c*. In model *O* for ocean craft ($w = 64$), the numbers are *b*, *c*, and *a*; in model *S* for salt-lake craft ($w = 72$), they are *c*, *a*, and *b*, respectively. What is the rated buoyancy?"

[*The Cal Klaters were Walter L. Shilts and Howard B. Stanley. The new problem developed from a suggestion by Richard Jenney. William W. Johnson adds to the history of the classical ladder problem given last month: versions appeared January 1918 in "Machinery," June 1920 in "American Mathematical Monthly," and April 1939 in "Scientific American," but none had integer solutions.*]

Construction to Start on Potholes Dam

CONSTRUCTION of Potholes Dam, a unit of the Bureau of Reclamation's vast Columbia Basin irrigation project, is expected to start late this summer, with completion scheduled for 1950. The dam, which is located on Crab Creek, west of Warden, Wash. (Fig. 1), will serve to impound seepage and return flow from about one-third of the project's lands. Re-use of this water will reduce pumping requirements at Grand Coulee Dam and also provide regulatory storage.

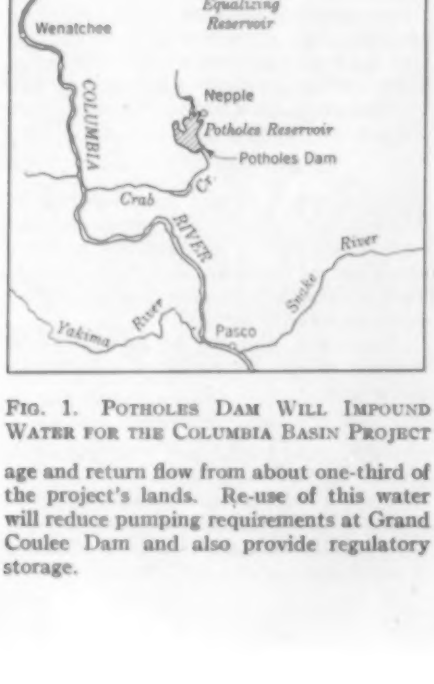


FIG. 1. POTHOLES DAM WILL IMPOUND WATER FOR THE COLUMBIA BASIN PROJECT

Potholes Dam, an earth-fill structure, will have a maximum height of 200 ft and a crest approximately $3^1/_2$ miles long. Nearly 10 million cubic yards of earth and rock will be used in the construction of the dam. Other engineering features include an open-channel spillway between sections of the embankment, and an outlet works with a concrete-lined tunnel about 700 ft long. The upstream slope of the embankment will be riprapped with a 3-ft layer of rock.

The Columbia Basin project is one of the largest reclamation developments ever to be undertaken. When completed, it will provide irrigation water for over a million acres of land in the Columbia River Basin. Construction of Grand Coulee Dam, key feature of the Columbia Basin development, was completed in 1942. A contract has recently been awarded for six pumps of unprecedented size and capacity for the Grand Coulee pumping plant. The vertical, single-impeller, centrifugal pumps will each be capable of pumping 1,600 cu ft per sec of water to a height of 270 ft.

The pumping plant will lift water from Lake Roosevelt at Grand Coulee into an equalizing reservoir to be formed by the construction of North and South Coulee dams. A contract for the construction of South Coulee Dam was recently awarded.

Stock Sizes of Rivets Simplified

BENEFITS to all concerned are expected to result from the general use of the simplified lists of recommended rivet sizes that have been prepared by the Division of Simplified Practice of the National Bureau of Standards, in cooperation with the industry. These lists should be an aid to purchasers and users by providing them with a guide to sizes that are readily available from stock.

The new Simplified Practice Recommendation establishes a voluntary simplified list of stock production sizes (lengths and diameters) for small rivets having a round head, flat head, truss or wagon box head, and countersunk head; also for belt rivets, tinners' and coopers' rivets, and large rivets with a button head.

Printed copies of Simplified Practice Recommendation R221–46, Steel Rivets, may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for 5 cents each. A discount of 25% is available on orders of 100 or more.

Kalamazoo Parking Lot Helps Business

AMONG the striking solutions to the downtown parking problem is that adopted by Kalamazoo, Mich., which offers shoppers a 400-car lot with free parking for two hours. A site for another lot of 180-car capacity is being acquired. The benefit-district plan adopted in Kalamazoo was worked out by city officials in close cooperation with merchants and property owners. The problem was seen as a mutual one. "Adequate parking means better and continued business; it preserves property values and taxes," as one city official said.

The cost of the present lot, $60,000, was met by an assessment formula, whereby the small zone of property adjacent to and near the lot paid 40%, a larger zone further away, 40%, and the larger zone of fringe property, 20%. Assessments, spread over 10 years, were made on the basis of one-half on tax valuation and one-half on square footage of each owner's property. After the first two free hours of parking, a small charge is collected, but relatively few shoppers stay over the free time. After 6 p.m., when attendants leave, parking is free.

The lot is managed under a unique control. A Shoppers' Parking Lot Board of five merchants and property owners meets periodically with the Kalamazoo city manager to set operational policies. Business men agree that the municipal lot has stabilized business. Before it was established, one large chain store refused to locate in the city. Afterward an established chain store, which had planned to move to the outskirts, decided to keep and enlarge its downtown premises. This Kalamazoo development was reported by the Automotive Safety Foundation.

New in Education

University of Michigan Gets Building Fund

THE LAST legislature of the State of Michigan provided funds in the amount of one million dollars for the construction of a new building to house the Departments of Electrical and Aeronautical Engineering of the University of Michigan. This building will be constructed as an addition to the East Engineering Building, which now houses the Departments of Chemical, Civil, and Aeronautical Engineering, and Metal Processing.

* * * *

University of Denver to Have Civil Engineering Department

A DEPARTMENT of civil engineering is being instituted by the University of Denver in September, to be headed by Prof. M. P. Capp, Jun. ASCE. The new course, leading to a bachelor's degree in civil engineering, may be taken in the traditional four years—or in five under a cooperative plan that includes work experience in an approved industry.

The University's college of engineering, headed by Dean Clarence M. Knudson, also offers courses in mechanical, electrical, chemical, and commercial engineering.

New Book Analyzes Problems of Airport Planning

PROBABLY the first modern treatise dealing exclusively with the fundamentals governing airport planning and design is *Airport Planning*, by Charles Froesch, Chief Engineer, and Walther Prokosch, Architect, both of Eastern Air Lines. Plans for the

book took root in the authors' minds as the result of a pamphlet they compiled three years ago in answer to questions asked by communities served by Eastern Air Lines, and also by others contemplating airport projects. The demand for a more complete and detailed coverage of the subject was impressive, coming from airport engineers, transportation executives, and others concerned with this vital aspect of the aviation industry. The book is profusely illustrated and contains a foreword by Capt. Eddie Rickenbacker, president and general manager of Eastern Air Lines.

The authors believe that there is more to planning an airfield than the mere technical details of design and construction. To be effective, they feel, an airport must be integrated into the overall transportation of the community. In their own words, the aims of the book are (1) to indicate the proper relationship of landing facilities to communities or regions which they serve; (2) to analyze those characteristics of aircraft affecting the planning and design of landing facilities; and (3) to strike a correct balance among the various elements comprising an airport.

Airport Planning stresses the broad approach to terminal planning problems, as opposed to purely engineering aspects. The clear style of writing, however, the up-to-date information, and the discussion of unchanging fundamentals and basic facts all serve to guide the planner to a practical development of ideas, and it is felt that the book will be of value to those who work in its field.

Both authors have had years of experience in the design and construction of fields and structures for major air lines, and Mr. Prokosch is currently serving as Chairman of the Boston Airport Terminal Building Committee.

Publishers of this volume are John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N.Y. The price is $7.

Oregon Highway Commission Issues "The Engineer at Law"

THE late Conde B. McCullough, M. ASCE, and his lawyer son, John R. McCullough, are joint authors of an impressive two-volume work entitled "The Engineer at Law—A Résumé of Modern Engineering Jurisprudence." The book was issued and sponsored under the engineering and legal research program of the Oregon State Highway Commission. The senior author—Conde B. McCullough, assistant state highway engineer for Oregon—died on May 6, 1946.

In its broad aspects, the book presents a bird's-eye view of the broad field of the law, pointing out the pitfalls into which the engineer may fall and warning of the necessity of consultation with experts on specific problems. In its more practical aspects, it is a mine of information applying directly to engineering problems. Of special interest are the chapters dealing with bidding blanks, plans, specifications, and construction contracts. In its approach to practical problems, the book is a necessary working tool of the engineer, since much of the responsibility for the phraseology of contracts and the like and most of the responsibility for the day-by-day interpretation of their terms and provisions rests directly upon the engineer in charge.

Application for the book may be made to the Oregon State Highway Commission, Salem, Ore., which has a limited supply available for sale at the cost of publication.

Book on New York Available

AN ILLUSTRATED volume entitled "New York and the Future" has been issued by the Bankers Trust Company of New York on the occasion of the opening of its new offices in Rockefeller Center. This survey of the economic and social prospects of the City of New York includes an economic and manufacturing forecast, as well as a review of the city's postwar problems and an evaluation of its position in the arts and sciences.

A limited number of copies are available to readers of CIVIL ENGINEERING on request to Mr. C. E. Hemminger, Development Department, Bankers Trust Company, New York 15, N.Y.

"Reclamation Era" Resumes Publication

AFTER suspension during the war years—since April 1942—the publication of the *Reclamation Era* has been resumed by the U.S. Bureau of Reclamation with the May 1946 issue. Its contents include lead articles by Representative John R. Murdock ("Veterans—Here's Your Farm") and by Commissioner of Reclamation Michael W. Straus ("Reclamation Faces the Peace").

The purpose of this publication is to inform the general public of the activities of the Bureau of Reclamation in opening up new areas of the country for settlement and in carrying out its many projects, which have this as their general aim.

Former subscribers will receive the issues due them. In spite of increased costs, the former yearly subscription rate of $1 still prevails. Inquiries regarding new subscriptions should be addressed to the *Reclamation Era*, U.S. Bureau of Reclamation, Department of the Interior, Washington 25, D.C.

Work of "Pacific Naval Air Bases" Vividly Told

AN OLD STORY now, but nevertheless one of the greatest construction feats of all time, is that of the work done before, and in the early days of, the war by PNAB (Pacific Naval Air Bases), an organization made up of eight contracting firms. This epic, which extends from 1939 through Pearl Harbor and until the Seabees took over, is told in *Builders for Battle*, by David O. Woodbury, and has an introduction by Vice Admiral Ben Moreell, Hon. M. ASCE, former Chief of the Bureau of Yards and Docks.

Early chapters deal with the premonitory rumblings of the Pacific conflict. Then in colorful and informal language the construction struggle itself is told, including the redoing of much of the work made necessary by the holocaust wrought by the Japanese attack on Pearl Harbor, Guam, Wake, etc.

This story of a desperate race against oncoming war is illustrated with 25 full-page pencil drawings by Lili Réthi, examples of whose work have appeared in CIVIL ENGINEERING from time to time. In addition there are 48 smaller pen and ink sketches by Louis H. Ruyl.

The publisher is E. P. Dutton and Company, 300 Fourth Avenue, New York 10, N.Y., and the price is $7.50.

St. Paul Plans for Better Living

THROUGH its City Planning Board, St. Paul (Minn.) has issued a profusely illustrated, 32-page booklet all about itself and its plans for future development. The booklet is aimed at the "man-in-the-street" and explains to him what planning is—and isn't, what he can do in his neighborhood to encourage better living, what is proposed to cure traffic congestion and blight, and what the achievements of the Planning Board are to date. A number of questions such as would be likely to occur to the average citizen are asked and answered.

Those desiring copies of this publication, entitled "Planning St. Paul for Better Living," should address the City Planning Board of St. Paul, Minn. A copy is on file in the Engineering Societies Library.

Naval Construction Battalion Records Deeds in North Africa

THAT the Seabees were good editors as well as engineers is attested by "A Record of the Deeds, Actions and Experiences of the 54th United States Naval Construction Battalion in North Africa," which was recently received at Society Headquarters.

The 132-page volume is handsomely illustrated with photographs and drawings, and many of the cartoons display an almost professional ability. In addition to making interesting reading, the book of course constitutes an invaluable record of the important role of the 54th Naval Construction Battalion in the invasion of North Africa. Lt. Comdr. Howard E. Phillips, Jun. ASCE, edited the volume.

New Laws Enable Boston to Solve Parking Problem

"GREATER Boston Needs Action," headlined a recent printed bulletin widely distributed in the Hub City by the Greater Boston Development Committee, and it got action. The State Legislature has passed, and the Governor has signed, enabling legislation which will permit Boston to make an all-out attack on the parking problem.

One measure permits the city to borrow $5,000,000 outside its debt limit to acquire sites and construct off-street parking lots or garages for operation by the highest private-enterprise bidders. Maximum parking fees

will be determined by the city. Another bill authorizes the city to permit private operators to construct and operate a parking garage under Boston Common. Public funds would not be involved in this enterprise.

The parking program will be integrated with the projected express highway known as Central Artery, which will cut directly through or near most of the principal traffic destinations. Central Artery is expected to relieve existing streets of more than 50,000 vehicles daily. That modern non-stop highway, plus the planned adjacent parking facilities, would entirely eliminate large volumes of traffic and parked cars now cluttering downtown streets.

NEWS OF ENGINEERS

Personal Items About Society Members

J. HOUSTOUN JOHNSTON, consulting engineer of Atlanta, Ga., received the honorary degree of doctor of science from the University of the South at Sewanee, Tenn., on June 10.

L. E. HOFFMANN has accepted a position with the consulting firm of Polk, Powell and Hendon, of Birmingham, Ala. Major Hoffman has just been released from the Corps of Engineers, U.S. Army, in which he was most recently assigned as chief of the management branch of the Repairs and Utilities Division, Seventh Service Command.

PERCY A. SEIBERT, for the past fifteen years general representative of the Braden Copper Company at Santiago, Chile, is now director of the Chile-American Association, with offices at 31 Nassau Street, New York 5, N.Y. Mr. Seibert has been associated with enterprises in Latin America since 1904, and was president of the Association in Chile for ten years.

MALCOLM PIRNIE, Past-President of the Society, has formed a partnership with his associates—ERNEST W. WHITLOCK, ROBERT W. SAWYER, G. G. WERNER, JR., and RICHARD HAZEN. The firm will continue its engineering practice under the name of Malcolm Pirnie Engineers, 25 West 43d Street, New York 18, N.Y.

DAN MENDELL, JR., has been promoted from the position of senior engineer for the Humble Oil and Refining Company at Houston, Tex., to that of division engineer of the West Texas division, with headquarters at Wichita Falls. Another member of the Society—PHILIP BARBER, a former lieutenant commander in the U.S. Naval Reserve—has been transferred from Louisiana to the Houston office of the organization in the capacity of assistant division engineer.

WALTER E. JESSUP has been awarded the Army Commendation Ribbon "for exceptionally meritorious services in a position of great responsibility as chief, Training Doctrine Section, Office of the Chief of Engineers, Washington, D.C." After three years of war service, Colonel Jessup returned to the Society and since last November has been in charge of the Society's Pacific Coast office in Los Angeles.

E. E. ERICSON is now associated with John T. Buckner in a general contracting practice at Cleburne, Tex. Mr. Ericson was recently released from the U.S. Naval Reserve, with the rank of lieutenant (jg).

HAROLD W. LIESKE, who has just returned to civilian life after service with the Corps of Engineers—with the Louisville District and later as lieutenant colonel on the General Staff in Washington, D.C.—has accepted the position of civil engineer with the Army Ground Forces Board No. 2, Fort Knox, Ky.

ROBERT S. HOLMES recently resigned as traffic engineer for the National Conservation Bureau in order to accept a Civil Service appointment as assistant to the War Department Safety Director. In this capacity he will be responsible for policy, administration, and supervision of all traffic engineering and safety activities connected with the Army Safety Program. Mr. Holmes was separated from the service in April 1946 as a lieutenant colonel in the Corps of Engineers after 62 months of service.

RAYMOND L. GOODSON and JAMES S. NAISMITH have returned to the Dallas (Tex.) office of Myers and Noyes after serving in the U.S. Naval Reserve. Mr. Goodson had the rank of commander, and Mr. Naismith that of lieutenant.

ROBERT H. DODDS has joined the civil engineering faculty of Colorado Agricultural and Mechanical College, at Fort Collins, Colo., in the capacity of associate professor. Mr. Dodds was released from active service in the Civil Engineer Corps of the U.S. Naval Reserve in May. A lieutenant commander, his final Naval position was as head of the historical division of the Bureau of Yards and Docks in Washington, D.C.

H. HICKS ALLEN is now commissioner of public works for the city of Corpus Christi, Tex. Until lately he was a major in the Corps of Engineers, U.S. Army.

CLAYTON N. WARD and John A. Strand have formed a new consulting firm under the name of Ward and Strand, with temporary offices at 550 State Street, Madison 3, Wis. The new firm will specialize in water, diesel, and steam power; water and sewerage works; flood control; irrigation and drainage; hydraulic research and hydrological investigation. For the past thirteen years Mr. Ward has been a partner and chief engineer in the firm of Mead, Ward and Hunt.

DUDLEY F. STEVENS has received his discharge from the U.S. Army after three years' service in the European Theater of Operations. He has returned to *Western Construction News* in the capacity of Northwest editor, with offices in Seattle, Wash.

RODERIC B. THOMAS has severed his connection as city engineer for Highland Park, Tex., in order to become city manager of Corpus Christi, Tex.

FERDINAND F. MAUTZ recently resumed his position as assistant engineer for the Pacific Gas and Electric Company in San Francisco after serving as a major in the Coast Artillery Corps of the U.S. Army. His latest assignment was in Korea.

MARK G. GARVER is now with the J. E. Greiner Company, of Baltimore, Md., for which he is making a survey of future construction possibilities in Gulf Coast cities. He was recently discharged from the Civil Engineer Corps of the U.S. Naval Reserve, with the rank of lieutenant.

WILLARD E. SIMPSON, JR., until lately a captain in the Corps of Engineers, U.S. Army, has become connected with his father's firm, the W. E. Simpson Company, in San Antonio, Tex.

JACK W. PRATT accepted a position with Process Engineers, Inc., in San Francisco, following his discharge from the Civil Engineer Corps of the U.S. Naval Reserve.

EDWARD W. THORSON has been made district engineer of the Portland Cement Association's newly established district office in Denver, Colo. Mr. Thorson was with the Association from 1934 until 1941 when he was called to active duty in the Civil Engineer Corps of the U.S. Naval Reserve. Upon his release from the Navy in 1945, he served as structural engineer for the Portland Cement Association, with headquarters in Minneapolis, Minn.

MORGAN E. STEWART is now assistant sanitary engineer in the California State Bureau of Sanitary Engineering at Berkeley, Calif.

GEORGE C. BUNKER has reopened his consulting offices in Panama, Republic of Panama. For almost ten years Mr. Bunker has been consulting engineer to the National Ministry of Public Works and the National Institute of Sanitary Works at Caracas, Venezuela, specializing in the development and purification of water supplies for the country.

M. CARLETON YODER, who was recently released from the Civil Engineer Corps of the U.S. Naval Reserve, has joined the engineering staff of Koebig and Koebig, of Los Angeles, Calif.

L. O. HOPKINS, JR., is now connected with the Chattanooga (Tenn.) firm of Schmidt, Peerson, and Hedman.

CHARLES D. DURFEE, JR., and NORMAN E. LANE have returned to the Civil-Architectural-Design Division of the Tennessee Valley Authority after serving as lieutenants (jg) in the Civil Engineer Corps of the U.S. Naval Reserve.

CHARLES A. MAYER, formerly connected with the New York firm of Dow and Smith, consulting paving engineers, has accepted a position as assistant engineer in the New York office of the Asphalt Institute, to act in the capacity of an administrative engineering assistant to the general manager.

H. R. WALKER, who for the past eight years has been with the Mosher Steel Company of Houston, Tex., as designing, consulting, and sales engineer, has founded the Walker Company, with headquarters in Houston. Mr. Walker will act as president of the new company and will be in charge of the design, development, and distribution of the products of L. C. Roney, Inc., in the states of Texas, Louisiana, and Oklahoma.

JOHN C. SPRAGUE, engineer-in-charge of the Division Materials Testing Laboratory, South Atlantic Division, Corps of Engineers, U.S. Army, has moved to Marietta, Ga., the headquarters of the laboratory having been transferred there from Jacksonville, Fla. Prior to his connection with the Corps of Engineers, Mr. Sprague was development engineer for the Dravo Corporation.

JOHN F. CURTIN, transportation engineer for Hawley S. Simpson, Philadelphia consultant, has just been awarded the Meritorious Civilian Service Award for his work on the development of passenger transportation services at the atomic bomb project. In the citation accompanying the award, General Somervell stated that the award was made "in recognition of exemplary performance of and devotion to duty in the Manhattan District of the Corps of Engineers." While at Oak Ridge, Mr. Curtin was chairman of the board that organized the transportation system.

JAMES B. WARD has severed his connection with the Geologic Division of the Tennessee Valley Authority in order to accept the position of district geologist for the U.S. Engineer Department at Mobile, Ala.

GEORGE E. SCHUMANN is now with Kaiser Engineers, Inc., at Oakland, Calif. He was formerly engineer in charge of design for Wilbur Watson and Associates, of Cleveland, Ohio.

WALTER G. ATTWELL, previously a consulting sanitary engineer in San Francisco and Berkeley, Calif., has accepted a position as sanitary engineer for Sonoma County, California.

MARTIN P. CAPP has been appointed head of the newly established department of civil engineering at the University of Denver. Since 1941 Professor Capp has been assistant professor of civil engineering at the Colorado School of Mines.

J. EDWARD CRABIEL, following his release from the Civil Engineer Corps of the U.S. Naval Reserve, has become construction superintendent for the Franklin Contracting Company, of Newark, N.J.

ARTHUR H. WEDGE is now city airport manager for Fort Wayne, Ind. Prior to entering the U.S. Army, from which he was recently released with the rank of lieutenant colonel, Mr. Wedge was city engineer for Wooster, Ohio.

ROBERT W. JOHNSON, until lately a captain in the Coast Artillery Corps of the U.S. Army, has accepted a position with the Minneapolis (Minn.) consulting firm of Hitchcock and Esterbook.

R. D. LANDON, formerly professor of civil engineering at Southern Methodist University, has been made dean of the college of engineering at the University of Akron (Ohio). He succeeds FRED E. AYER, who has retired as dean but will continue to teach for another year.

CHARLES A. BATTERSHILL, consulting engineer of Chicago, Ill., was recently appointed city engineer of Vancouver, B.C.

JOHN E. KITCHEN has resigned as senior engineer and head of the Sacramento District sub-office at Salt Lake City, Utah, in order to establish a private practice in Reno, Nev. During his tenure with the Corps of Engineers, Mr. Kitchen supervised the construction of the Sierra Ordnance Depot.

CLIFFORD JOHNSON recently severed his connection as bridge engineer for the North Dakota State Department of Highways in order to establish a private engineering practice in Denver, Colo.

EDWIN H. MARKS, colonel, Corps of Engineers, U.S. Army, has been assigned to duty as division engineer of the recently created South Pacific Division of the Corps of Engineers, with headquarters in San Francisco, Calif. Colonel Marks was previously division engineer for the Southwestern Division at Dallas, Tex., having the wartime rank of brigadier general.

LAVERN TEMPLE is now city engineer of Dubuque, Iowa. Until lately he was in the Civil Engineer Corps of the U.S. Naval Reserve.

JAMES L. NEVILLE, who was just released from the Sanitary Corps of the U.S. Army, with the rank of captain, has accepted the position of city engineer of Scottsbluff, Nebr.

ROY L. GARDNER, following his release from the Corps of Engineers, U.S. Army, in which he had the rank of major, resumed his position with the Seattle (Wash.) consulting firm of Gardner, Gardner and Hitchings.

W. F. ARKSEY and C. F. INTLEKOFER have returned to the engineering staff of the Great Northern Railway in Minneapolis, Minn., after wartime service in the Army and Navy. The former was with the 704th Railway Division of the U.S. Army in Africa and Italy, while Mr. Intlekofer was in the Pacific area with the 128th Naval Construction Battalion.

OLE SINGSTAD, New York City consultant and former Director of the Society, received the honorary degree of doctor of science from St. Olaf College at Northfield, Minn., at the annual commencement exercises in June. Widely known for his work as consultant on large vehicular and other tunnels, Dr. Singstad was chief engineer of the New York City Tunnel Authority from 1936 to 1945.

E. N. GUSTAFSON has resigned as district highway engineer for the Portland Cement Association at Austin, Tex., in order to become vice-president and general manager of the Bayou Concrete Products Company, with headquarters in Houston, Tex.

JOSEPH VERANTH, formerly a lieutenant commander in the U.S. Navy, has formed a general contracting firm with Thomas J. Fowler. The new organization, to be known as the Fowler-Veranth Construction Company, will be located at Duluth, Minn.

CHESTER H. CANHAM is now branch manager of the Indiana State Health Department's sanitary engineering office at Terre Haute, Ind.

WILLIAM H. NELSON, following his release as a colonel in the Corps of Engineers, U.S. Army, is returning to his former position as senior civil engineer for the city of Seattle, Wash.

JAMES S. ANDERSON, formerly a civil engineer for Harland Bartholomew and Associates, of St. Louis, Mo., has become building commissioner and engineer of Wilmette, Ill.

E. G. SINGLETARY has returned to the V. B. Higgins Construction Company at Greensboro, N.C., after wartime service as a lieutenant commander in the Civil Engineer Corps of the U.S. Naval Reserve.

A. E. NIEDERHOFF has severed his connection with the Seattle office of the Austin Company in order to accept a position as senior engineer on design for the Naval Ordnance Testing Laboratory at Inyokern, Calif.

WILBOURNE O. JONES is now acting city manager of Fort Worth, Tex. He was previously director of public works for Fort Worth, in which capacity he will be succeeded by C. MILO THELIN, former assistant city engineer.

CALVIN O. JOYNER, for the past two and a half years head of the Lend-Lease Mission in China, is now in charge of the policy and direction of all Korean industry for the American Military Government of that country, with headquarters at Seoul.

LEON A. PADDOCK retired on July 1 as president of the American Bridge Company and the Virginia Bridge Company. After many years with the Canadian Bridge Company, Mr. Paddock became connected with the American Bridge Company in 1927 in the capacity of vice-president. He was elected president in 1931, and in 1936 also became president of the Virginia Bridge Company.

JOSEPH A. SALE, who was recently discharged from the Civil Engineer Corps of the U.S. Naval Reserve, with the rank of lieutenant (jg), has accepted the position of field engineer for the Jefferson Chemical Company at Beaumont, Tex.

EDWARD M. BEARDSLEE has been appointed city manager of Jacksonville Beach, Fla., and assumed his duties there on July 16. He has been city manager of Fernandina, Fla., since October 1945, and prior to that was city manager at De Land, Fla.

DECEASED

WILLIAM ANDREW ALLEN (M. '04) retired engineer of West Orange, N.J., died there on June 27, 1946. Mr. Allen, who was 78, was connected with the American Smelting and Refining Company, of New York, N.Y., for thirty-six years—for most of this period in the capacity of superintendent of construction. He retired in 1932.

FRANCIS CYRUS BAGBY (Assoc. M. '13) president of the Western Waterproofing Company, of Detroit, Mich., died on May 3, 1946. He was 60. Beginning in 1910, Mr. Bagby was for a number of years connected with the Corrugated Bar Company—first as district manager in St. Louis, Mo., and later in Detroit. He had been associated with the Western Waterproofing Company since 1929.

GEORGE WILLIAM BORDEN (Assoc. M. '18) engineer for the U.S. Engineer Department at Sacramento, Calif., died on June 11, 1946, at the age of 64. Mr. Borden had been with the Washington State Highway

Department and the Nevada State Highway Department, and from 1929 to 1932 was assistant sales manager of the asphalt department of the Shell Oil Company. From 1933 to 1941 he was park engineer and associate engineer for the National Park Service, with headquarters in San Francisco, Calif., and for the past five years he had been in the U.S. Engineer Department at Sacramento, in charge of the design of airfield pavements. He was active in the Sacramento Section, and had recently served as chairman of its Committee on Membership.

ORA BUNDY (M. '22) engineer and contractor of Ogden, Utah, died in that city on June 12, 1946. Mr. Bundy, who was 63, had maintained his own engineering and contracting organization for many years. In this capacity he was engaged on the construction of numerous important projects in Utah, including Pine View Dam and the Ogden arsenal. Active in civic affairs, he had been mayor of Ogden, and at the time of his death was president of the National Reclamation Association. During the first World War Mr. Bundy served as an officer in the Corps of Engineers.

CLARENCE DEXTER CONWAY (Assoc. M. '20) manager of the Coneland Water Company and the Los Molinos Land Company, Los Molinos, Calif., died in Red Bluff, Calif., on June 19, 1946. Mr. Conway, who was 57, had been connected with the Coneland Water Company since 1916. From 1911 to 1913 he was engineer for the Los Molinos Land Company in charge of the sub-division and construction of a large irrigation system, and later he became manager of the company. He was well known in the Sacramento area for his work on flood control and stream clearance for the Sacramento River.

THOMAS HENRY CROSWELL (M. '08) of Brainerd, Minn., died there on May 24, 1946, at the age of 79. From 1890 to 1899 Mr. Croswell was engaged in government and private surveying, and beginning in 1900 he was for a number of years with the Northern Pacific Railway. During the latter period he was engineer on the construction of many bridges for the railroad, and for some years he was principal assistant engineer at Spokane in charge of the construction of several branch lines. More recently he had been president of the Cayuna Range Power Company at Ironton, Minn.

HERBERT LUTHER DUNN (Assoc. M. '05) civil engineer for the Connecticut Broach and Machine Company, New London, Conn., died on May 9, 1946. His age was 77. From 1899 to 1910 Mr. Dunn was engineer for the Draper Corporation of Hopedale, Mass., on the layout of industrial towns and plants; from 1910 to 1924, construction engineer for Merritt-Chapman and Scott, New York marine engineers, on port and terminal work; and from 1927 to 1929, with the Westinghouse Electric and Manufacturing Company. More recently (1935 to 1942) he was supervising engineer for the Trumbull Airport at Groton, Conn., and in the latter year he became connected with the Connecticut Broach and Machine Company.

THOMAS VICTOR HODGES (M. '40) engineer for the Schuylkill River project, Harrisburg, Pa., died on June 12, 1946, at the age of 64. From 1915 to 1924 Mr. Hodges was with the Solvay Company, of Syracuse, N.Y.; from 1924 to 1927, manager of the J. M. Cranston Building Material Company; from 1927 to 1929, with water companies of the Pennsylvania Railroad; and from 1929 to 1931, with the Philadelphia Suburban Water Company on the construction of dams and a filter plant. From 1932 on he was with the Commonwealth of Pennsylvania—first as assistant director of waters in the Department of Forests and Waters, and more recently on the Schuylkill River project.

HAROLD RISTINE HOLMES (M. '33) chief sewer engineer for the Bureau of Sewers of the City of Milwaukee, Wis., died on June 6, 1946. Mr. Holmes, who was 61, had been with the Milwaukee Bureau of Sewers since 1925, and had been chief sewer engineer since 1937. Earlier in his career he had been with the New York City Public Service Commission; city engineer of Lockport, N.Y.; assistant engineer for the Long Island Railroad Company; and engineer for Consoer, Older and Quinlan, Chicago consultants.

JOHN CLAYTON HOYT (M. '09) former Director and Vice-President of the Society, died at his summer home in Paris, Va., on June 21, 1946. He was 72. A biographical sketch of Mr. Hoyt's career and a photograph appear in the "Society Affairs" section of this issue.

JOHN FREDERIC MANGOLD (Assoc. M. '15) associate professor of mechanics at the Illinois Institute of Technology, Chicago, Ill., died recently. Professor Mangold, who was 60, was associate professor of mechanics at the Armour Institute of Technology from 1919 to 1941, and in the latter year became connected with the Illinois Institute of Technology. Earlier in his career he had been on the engineering staff of Grinnell College and the South Dakota State School of Mines, and from 1913 to 1917 he was city engineer of Grinnell, Iowa. Professor Mangold was the author of texts on the mechanics of motion and strength of materials.

LEROY MONROE MILNER, SR. (Assoc. M. '40) engineer for the U.S. Engineer Office at Memphis, Tenn., died on May 7, 1946, at the age of 56. From 1923 to 1938 Mr. Milner was a member of the firm of the Milner Engineering Company, operating in Sheffield, Florence, Tuscumbia, and Haleyville, Ala. From 1928 on he had also been in the U.S. Engineer Office at Memphis—since 1933 as engineer in charge of maintenance and improvement work on tributaries of the Mississippi in the district.

EJNAR JONSBERG MULLER (M. '08) of Shanghai, China, died in that city in August 1942, though word of his passing did not reach the Society until now because of the war. He was 68. Born and educated in Norway, Mr. Muller spent his early career with the American Bridge Company in this country. In 1903 he went to China as designer of bridges for the Shanghai Municipal Council, and then became chief engineer for the Anhui Railway Company. Later he maintained a consulting practice in Shanghai, and at the time of his death was connected with Norwegian civil engineers in that city.

WILLIAM DAVID PENCE (M. '99) consulting engineer of Chicago, Ill., died on June 16, 1946, at the age of 80. Mr. Pence had been professor of civil engineering at the University of Illinois, Purdue University, and the University of Wisconsin. Later (1913 to 1921) he was a member of the engineering board of the Interstate Commerce Commission in charge of the federal valuation of railways. He was the author of several books and manuals, and in 1901 received the Octave Chanute Medal of the Western Society of Engineers for his work on the thermal expansion of concrete. From 1909 to 1915 Mr. Pence was also editor of the publications of the American Railway Engineering Association.

Changes in Membership Grades

Additions, Transfers, Reinstatements and Resignations

From June 10 to July 9, 1946, Inclusive

ADDITIONS TO MEMBERSHIP

ARNAL, EDUARDO ANTONIO (Assoc. M. '46), Chf. Engr., Oscar Zulaoga y Compania, Apartado 263, Caracas, Venezuela.

BACON, MAURICE WARDER (Assoc. M. '46), Architectural Engr., Ford, Bacon & Davis, Inc., Cons. Engrs., 39 Broadway, New York 6, N.Y.

BEARD, JAMES RICHARD (Jun. '46), 1st Lt., U.S.-M.C., 2607 Oak View Terrace, Maplewood, Mo.

BELCHER, GLENN THEODORE (Assoc. M. '46), Engr. (Civ.) P-4, U.S. Dist. Engr., Fort Armstrong, Headquarters Bldg. (Res., 935 Prospect St.), Honolulu 25, T.H.

BENNETT, PRESTON THEODORE (M. '46), Soil Mechanics Engr., U.S. Engr. Office, 1709 Jackson St. (Res., 1944 South 61st St.), Omaha 6, Nebr.

BESEL, RALPH CARL (Jun. '45), Hydr. Engr., U.S. Bureau of Reclamation, Room 41 New Customs, Denver (Res., 3363 Jay Rt Box 12A, Wheat Ridge), Colo.

BIEVER, CARL ARTHUR (Assoc. M. 46), Topographic Engr., U.S. Geological Survey, Box 133, Rolla, Mo.

BORLAND, VICTOR JAMES (Assoc. M. '46), Asst. Engr. and Engr., Los Angeles County Sanitation Districts, 1206 South Maple Ave., Los Angeles 15 (Res., 885 Oneonta Drive, South Pasadena), Calif.

BRITAIN, KENNETH EDWARD (Assoc. M. '46), Asst. to Chf. Civ. Engr., The Pure Oil Co., 911 Esperson Bldg. (Res., 2821 Rosedale), Houston 4, Tex.

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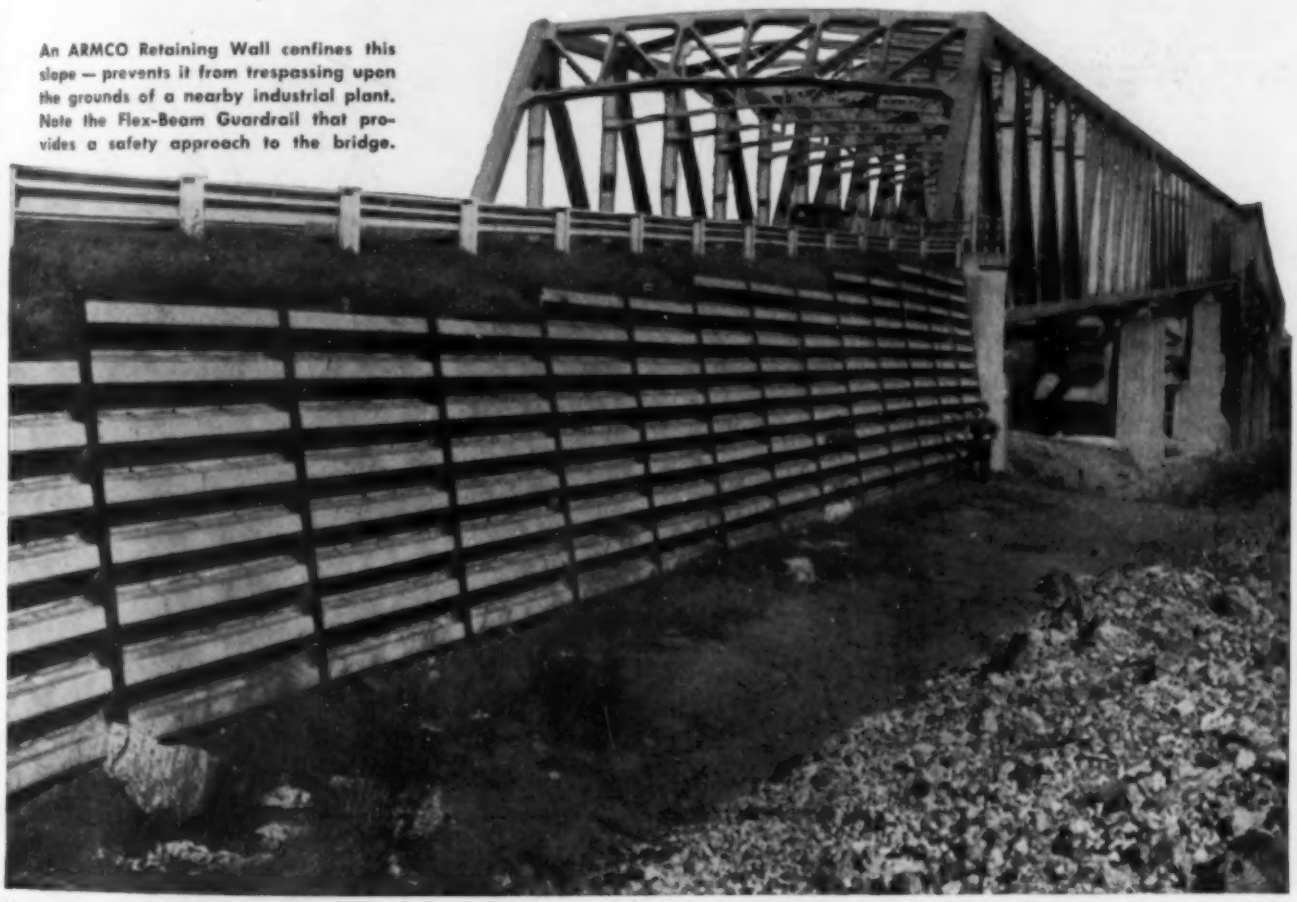

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BUCH, GEORGE QUENTIN (Jun. '46), Eng. Employee, The Tom W. Carpenter Constr. Co., Box 888, Amarillo (Res., 3441 Woodland Drive, Abilene), Tex.

BURCHELER, WILLIAM GOTTLOB (Assoc. M. '46), Specification Writer & Plans Coordinator, Reynolds, Smith & Hills, Archts. & Engrs., 10 South Laura St. (Res., P.O. Box 1634), Jacksonville 1, Fla.

BURTON, ALBERT HARVEY (M. '46), Col., Corps of Engrs., U.S. Army, Director of Real Estate, Office, Chf. of Engrs., U.S. Army, New War Dept. Bldg., Washington, D.C. (Res., 1300 South Cleveland St., Apt. 303 Arlington Village, Arlington, Va.)

BUZETA-QUEZADA, SERGIO (Jun. '46), Asst. Engr., Departmento de Hidraulica (Obras Publicas), Morande 45 (Res., Providencia 969), Santiago, Chile.

CHANEY, ADRIAN BYRON (M. '46), Dist. Engr., Mo. Pac. R.R., 204 Union Station (Res., 5318 Centerwood Road), Little Rock, Ark.

CLINE, JAMES ALBERT (Assoc. M. '46), Constr. Engr., U.S. Engr. Dept. (Res., 4539 North 36th Ave.), Omaha, Nebr.

COHEN, SAMUEL (M. '46), Civ. Engr., 11 West 42d St. (Res., 2700 Marion Ave.), New York 58, N.Y.

CULL, ROSWELL WILLIAM (Assoc. M. '46), Special Constr. Engr., The Lakefront Dock & R.R. Terminal Co., 1118 Madison St. (Res., 2408 Maplewood Ave.), Toledo 6, Ohio.

DAVIS, FROHMAN PAUL (Jun. '46), Junior Structural Engr., Elwyn E. Seelye & Co., 101 Park Ave., New York (Res., 349 Ave. O, Brooklyn), N.Y.

DOSHI, AMRITLAL GHELABHAI (Assoc. M. '46), State (Chf.) Engr., Gondal State, State Engr.'s Bungalow, Gondal, India.

DUNCAN, WILLIAM MUNRO (Jun. '46), Engrs. Asst., Head Office, Public Works Dept., Wellington (Res., 29 Waterloo Rd., Lower Hutt), New Zealand.

ELLETT, EMERSON SKINNER (Assoc. M. '46), Engr., Colorado Fuel & Iron Corp., Continental Oil Bldg. (Res., 1642 Clermont St.), Denver 7, Colo.

FIELD, MELVIN PRINCE (Assoc. M. '46), Chf. Engr. of Constr., Anderson, Clayton & Co., P.O. Box 2538, Houston 1, Tex.

FLYNN, JOHN JOSEPH FRANCIS (Assoc. M. '46), 5216 Delafield Ave., New York 63, N.Y.

GARRISS, CHARLES HENRY (M. '46), Civ. Engr., U.S. Navy Dept., Bureau of Yards and Docks, Public Works Office Bldg., U.S.M.C.A.S., Cherry Point (Res., 5-H Ocracoke Drive, P.O. Box 285, Havelock), N.C.

GITER, JERRY LEO (Jun. '46), 17415 Birchcrest Drive, Detroit 21, Mich.

GONZALEZ-RUVIO, ELBERTO, JR. (Jun. '46), Structural Designer, James J. Pollard, Dept. of Architecture, Georgia School of Technology, Atlanta, Ga.

GRAHAM, MALCOLM DOUGLAS (Jun. '46), Ensign, U.S. Navy, 125 Howard St., Pittsfield, Mass.

GREEN, ALFRED RICE (Assoc. M. '46), Associate Hydr. Engr., U.S. Geological Survey (Res., Meadowbrook Heights), Charlottesville, Va.

TOTAL MEMBERSHIP AS OF JULY 9, 1946	
Members	6,402
Associate Members	8,298
Corporate Members	14,700
Honorary Members	36
Juniors	6,637
Affiliates	76
Fellows	1
Total	21,450
(July 9, 1945	20,901)

GRESSITT, JOHN LYELL (M. '46), Chf. Engr., Pennsylvania R.R., 1658 Broad St. Station Bldg. Philadelphia 4, Pa.

GRIFFIN, WILLIAM COMER (Assoc. M. '46), Asst. Hydr. Engr., U.S. Geological Survey, P.O. Box 56, Montgomery 1, Ala.

HEALY, JOHN JOSEPH (Jun. '46), Ensign, CEC, U.S.N.R.; 91 Gore St., Waltham, Mass.

HENRY, RONALD POWELL (Assoc. M. '46), Field Engr., Lockwood, Kessler & Bartlett, 32 Court St., Brooklyn (Res., 149-07 Barclay Ave., Flushing), N.Y.

HESLIN, RICHARD FREDERICK (Jun. '45), Ensign, U.S.N.R., 4546 Nineteenth North East, Seattle 5, Wash.

JOHNSTON, ELWOOD RUSSELL, JR. (Jun. '46), Asst. and Graduate Student, Massachusetts Inst. of Technology, Room 1-230 M.I.T., Cambridge 39, Mass.

JORGENSEN, JAMES FRANK (Assoc. M. '46), Associate Highway Engr., State Div. of Highways, 1365 Harbor St. (Res., 4537 Fortieth St.), San Diego 4, Calif.

LEVEY, BERTRAM (Jun. '46), 8 Oak St., Farmingdale, N.Y.

LINDLEY, JOHN FRANCIS (Jun. '46), Asst. Structural Engr., Walter Scholer & Associates, Archts., 1114 State St., Lafayette (Res., 114 De Hart St., West Lafayette), Ind.

LITVIN, ROBERT LOWELL (Jun. '46), Vice-Pres., Thomas H. Litvin Plumbing Co., 123 North Desplaines St., Chicago, Ill.

MOORE, EMMETT BURRIS (Assoc. M. '46), Prof. of Civ. Eng., State College of Washington, Pullman, Wash.

NESTER, NORMAN WILLIAM (M. '46), Maj., Corps of Engrs., U.S. Army, 129 Central Ave., Dayton 6, Ohio.

PAYDEN, NEAL FRANKLIN (Jun. '46), Structural Engr., Beling Eng. Co., 1407 Seventh Ave. (Res., 2526 Twelfth Ave.), Moline, Ill.

PRENDES, ANTONIO GARCIA (Assoc. M. '46), Highway Bridge Engr., Public Roads Administration, Apartado Q, San Jose, Costa Rica. (Res., Avenida Norte No. 40, Guatemala City, Guatemala, C.A.)

PRESTON, DAVID BEMIS (Jun. '46), Ensign, D (L), U.S.N.R.; 112 Warren St., Medford, Mass.

RICHARDSON, EDWARD CHARLES (Assoc. M. '46), Maj. Corps of Engrs., U.S. Army, Military Dept., Missouri School of Mines, Rolla, Mo.

ROGERS, SHERMAN LEFFINGWELL (Assoc. M. '46), Asst. Supt., Met. Dist. Water Bureau, Hartford (Res., 400 Prospect St., Wethersfield), Conn.

RUSH, VICTOR ANTHONY (Assoc. M. '46), Designer, M. W. Kellogg Co., 225 Broadway (Res., 344 East 196th St.), New York 58, N.Y.

SANNER, EDWARD REED (Assoc. M. '46), Head Industrial Engr., Frederic R. Harris Eng. Corp., Daylight Bldg. (Res., 2022 Lawson Ave.), Knoxville 7, Tenn.

SCHWARZBACH, ALVIN LEON (Jun. '46), Ensign, U.S.N.R.; 100 South Central Ave., Chicago 44, Ill.

SCOTT, VERNE HARRY (Jun. '46), Mechanician in Div. of Irrig., Univ. of California Agriculture School, Davis, Calif.

TAIT, ROBERT JAMES (Assoc. M. '46), Cons. Civ. Engr., Stewart, Shand and Oliver, Box 1247, Cape Town, South Africa.

VANCE, JAMES ALFRED (M. '46), Engr. and Constr., Woodstock, Ont., Canada.

TRIEM, ROBERT JOSEPH (M. '46), Dist. Road Engr., U.S. Indian Service, 215 Federal Office Bldg., Minneapolis, Minn.

WEHNER, RICHARD HAROLD, JR. (Jun. '45), Bldg. Insp. Naval Base, Mare Island (Dixon), Gen. Delivery, Dixon (Res., 1348 Martin Ave., San Jose), Calif.

WILLIAMS, STEPHEN MILLER, JR. (M. '46), Pres., William Brothers Corp., Engrs.-Constrs., 324 National Bank of Tulsa Bldg., Tulsa, Okla.

WOOD, CARROLL LEE, JR. (M. '46), Engr., Perrilliat Rickey Const. Co., 1530 South Rendon (Res., 4510 South Prieur), New Orleans, La.

WYNN, GEORGE MCELVEEN (Assoc. M. '46), Civ. Engr., Eng. Dept., Georgia Power Co. (Res., 1079 North Virginia Ave., N.E.), Atlanta, Ga.

MEMBERSHIP TRANSFERS

BARNES, DONALD PORTER (Jun. '30; Assoc. M. '36; M. '46), Engr. Asst. to Asst. Chf. Civil Engr., Branch of Design and Constr., U.S. Bureau of Reclamation, Denver (Res., 5252 South Franklin St., Box 100A, Route 3, Littleton), Colo.

BOBLOW, REUBEN (Jun. '23; Assoc. M. '31; M. '46), Civ. Engr., Cia Morrison Knudsen do Brasil S.A., Rua Santa Luzia 798-15° Andar, Rio de Janeiro, Brazil.

BOW, WILSON FRANCIS (Jun. '36; Assoc. M. '46), Senior Public Health Engr., State Dept. of Health, 1405 Smith Tower (Res., 7713 Eighteenth Ave., N.W.), Seattle 7, Wash.

BROUK, OTTO (Assoc. M. '41; M. '46), Engr., Turner Constr. Co., 420 Lexington Ave., New York (Res., 65 Homestead Ave., Scarsdale), N.Y.

CALLINAN, BERNARD JAMES (Jun. '37; Assoc. M. '46), Associate Cons. Engr., Gutteridge, Haskins & Davey, 472 Bourke St., Melbourne, C.1, Victoria, Australia.

GILMAN, ROGER HOWE (Jun. '36; Assoc. M. '46), Asst. to Director of Port Development, Port of New York Authority, 111 Eighth Ave., New York 11, N.Y.

HATCH, GEORGE EDWIN (Jun. '26; Assoc. M. '46), Chf., Materials Testing Laboratories, U.S. Engr. Office, Honolulu, Hawaii.

HILL, CHARLES LEONARD (Assoc. M. '30; M. '46), Sec. and Mgr., Nevada Chapter, Associated Gen. Contrs. of America, Inc., P.O. Box 608 (Res., 1231 Arlington Ave.), Reno, Nev.

HOLLISTER, LEONARD COCHRAN (Assoc. M. '27; M. '46), Senior Bridge Engr., State Bridge Dept., P.O. Box 1499 (Res., 2785 Marty Way), Sacramento 14, Calif.

HOUSNER, GEORGE WILLIAM (Jun. '35; Assoc. M. '46), Asst. Prof., Applied Mechanics, California Inst. of Technology (Res., 4084 Chevy Chase Drive), Pasadena 2, Calif.

O'NEIL, HUGH MICHAEL (Jun. '39; Assoc. M. '46), Structural Engr. (H. M. O'Neil Co., Cons. Engrs.), 610 Sixteenth St., Oakland 12, Calif.

PEREZ GUERRA, GUSTAVO LUIS (Jun. '41; Assoc. M. '46), Design Engr., Consulting Engineers, C.A., Apartado 165, Caracas, Venezuela.

PHILLIPS, HENRY ARTHUR (Jun. '42; Assoc. M. '46), Junior Designer, Water Bureau of Hartford Met. Dist., 1026 Main St., Hartford (Res., Torrington Ave., R.D. No. 1, New Hartford), Conn.

PINE, EDWARD LEONARD (Jun. '38; Assoc. M. '46), Engr., Isbell Constr. Co. (Res., 270 Clermont St.), Reno, Nev.

RAMSEY, JAMES BUTLER (Jun. '37; Assoc. M. '46), Chf. Engr. and Supt., City Water Dept., 4th Floor, City Hall (Res., 1101 East 60th St.), Kansas City, Mo.

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RUTTER, EDWARD JACKSON (Assoc. M. '28; M. '46), Hydr. Engr., T.V.A., Knoxville, Tenn.

ST. CLAIR, WILLIAM THADDEUS (Assoc. M. '33; M. '46), Asst. to Pres., Poe Piping and Heating Co. (Res., 400 Cleveland St.), Greenville, S.C.

SHAND, NINHAM (Assoc. M. '28; M. '46), Cons. Civ. Engr. (Stewart, Shand and Oliver), Box 1347, Cape Town, Union of South Africa.

REINSTATEMENTS

COVAS, PERFECTO ANTONIO, Assoc. M., reinstated May 7, 1946.

DANIEL, ISAAC CRAWFORD, Assoc. M., readmitted May 20, 1946.

HENSHAW, LAMOND FORBES, Assoc. M., readmitted May 20, 1946.

OLDHAM, JENNINGS BRYAN, Assoc. M., reinstated June 4, 1946.

PLETTA, DAN HENRY, Assoc. M., reinstated June 6, 1946.

RAWSTRON, FREDERICK JOSEPH, Assoc. M., reinstated Apr. 22, 1946.

THURBER, PAUL, Assoc. M., reinstated June 20, 1946.

WISHART, ARCHE, Jun., reinstated Jun. 21, 1946.

Applications for Admission or Transfer

Condensed Records to Facilitate Comment from Members to Board of Direction

AUGUST 1, 1946 NUMBER 8

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years RCM*
Associate Member	Qualified to direct work	27 years	8 years	1 year RCA*
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years RCM*

* In the following list RCA (responsible charge—Associate Member standard) denotes years of responsible charge of work as principal or subordinate, and RCM (responsible charge—Member standard) denotes years of responsible charge of IMPORTANT work, i.e., work of considerable magnitude or considerable complexity. The time statements shown are as presented by the applicant.

APPLYING FOR MEMBER

ARISON, SOLOMON BENJAMIN (Assoc. M.), Brooklyn, N.Y. (Age 56) (RCA 6.5 RCM 19.8) Oct. 1936 to date Asst. Engr. Designer, Gr. 4, later Civil Engr., Board of Water Supply, City of New York.

AULD, DAVID VINSON (Assoc. M.), Washington, D.C. (Age 38) (RCA 5.4 RCM 8.1) July 1946 to date Supt. and Chf. Engr., Water Div., District of Columbia Eng. Dept.; previously, Acting Director (Sept. 1941 to Nov. 1943) and Director (Nov. 1943 to July 1946), War Public Works Projects for the District of Columbia's War Public Works Program.

BOWIE, NATHANIEL MORTIMER, Lafayette, La. (Age 44) (RCA 8.9 RCM 9.2) 1941 to date Chf. Engr. and since 1943 also Vice-Pres. and Secy., Thomas Bryan & Associates, Inc., Engrs. and Constrs., Lafayette, La., previously with FHA.

BRANDES, RAYMOND LAWRENCE (Assoc. M.), New York City. (Age 42) (RCA 1.0 RCM 15.5) April 1943 to date Chf. Engr., Wininiger & Seeley, Inc., and Chf. Structural Engr., The Nicholson Co., Inc., New York City; previously with W. J. Barney Corp., New York City; private practice.

BUDNIK, Cass A. (Assoc. M.), Hastings, Nebr. (Age 45) (RCA 4.2 RCM 6.0) Sept. 1942 to date with Maxon Constr. Co., since March 1945 as Field Supt.; previously, Res. Engr., Carribean Archts. and Engrs.

CHAMBERLIN, FREDERICK BRYAN, West Hartford, Conn. (Age 54) (RCA 3.3 RCM 25.0) 1924 to 1934 Asst. Town Engr., and 1934 to date, Town Engr., West Hartford, Conn.

CIFFRIN, ASSAF, New York City. (Age 52) (RCA 3.5 RCM 15.0) Jan. 1941 to date Senior Research Engr., New York Univ.; previously, graduate student.

CLYDE, GEORGE DEWEY (Assoc. M.), Logan, Utah. (Age 48) (RCA 6.5 RCM 17.5) Feb. 1946 to date Chf., Irrigation & Water Conservation Div., SCS, U.S. Dept. of Agriculture; previously with Utah State Agricultural Coll.

COBB, GUY WILLIAMS (Assoc. M.), Little Rock, Ark. (Age 56) (RCA 14.0 RCM 17.8) Nov. 1934 to date with Arkansas Highway Dept., since March 1945 as Engr. of Surveys.

OLWELL, CURTIS COLFAX, Newark, N.J. (Age 57) (RCA 8.4 RCM 17.4) April 1929 to date with County of Essex, N.J., since May 1944 County Engr. and Supervisor of Roads.

COOK, JOHN WREN, JR., Arlington, Va. (Age 40) (RCA 8.7 RCM 6.7) April 1941 to date with CEC, USNR, at present as Commdr.; previously with Russell & Axton, Cons. Engrs., St. Louis, Mo.

COOK, ROBERT LEE, Houston, Tex. (Age 44) (RCA 3.0 RCM 13.1) Jan. 1928 to Nov. 1942, Dec. 1945 to date with Missouri Pacific Lines, Houston, Tex., since May 1931 as Asst. Engr.; in the interim with U.S. Army.

EATON, RICHARD ORVILLE (Assoc. M.), San Marino, Calif. (Age 38) (RCA 0.8 RCM 6.7) Jan. 1943 to date with Corps of Engrs., War Dept., U.S. Army, after Sept. 1945 as Lt. Col.; since Feb. 1946 Senior Engr., Los Angeles Engr. Dist.; previously with U.S. Engr. Office.

FOX, FREDERICK HEWITT, New Orleans, La. (Age 52) (RCA 6.3 RCM 22.2) Sept. 1921 to Jan. 1941 and Nov. 1945 to date with Tulane Univ., New Orleans, La., since 1925 as Associate Prof. of Civ. Eng.; in the interim with U.S. Army.

FREEMAN, ERNEST MAYNARD (Assoc. M.), Shreveport, La. (Age 45) (RCA 0.5 RCM 21.2) Feb. 1930 to date Cons. Engr., Shreveport, La.

GRUBB, ALBERT LESLIE, Baltimore, Md. (Age 41) (RCA 3.2 RCM 9.0) Oct. 1930 to date with Maryland Roads Comm., since July 1939 as Asst. Bridge Engr.

HADLEY, HOMER MORE (Assoc. M.), Seattle, Wash. (Age 60) (RCA 7.0 RCM 26.0) April 1946 to date Consulting Engr., private practice; previously with Portland Cement Association, Chicago, Ill., after July 1921 as Regional Structural Engr.

HANLEY, TURE JOHN, Long Beach, Calif. (Age 41) (RCA 3.3 RCM 7.7) June 1941 to date at Naval Base Terminal Island, Calif., since June 1942 as Chf. Structural Engr.; previously with U.S. Bureau of Reclamation.

HATCH, BERNARD FRANKLIN (Assoc. M.), Columbus, Ohio. (Age 48) (RCA 3.6 RCM 17.4) May 1940 to April 1941 and Jan. 1946 to date member of firm, Burgess & Niple, Civ. and San. Engrs., Columbus, Ohio; in the interim, Capt. to Col., Corps of Engrs., U.S. Army.

HEIDEMA, PETER BAREld (Assoc. M.), Galveston, Tex. (Age 48) (RCA 5.9 RCM 10.5) July 1936 to date with U.S. Engrs., since Feb. 1942 as Associate Engr., Galveston, Tex.

HENDRIKSEN, OSCAR HAGBARTH, W. Los Angeles, Calif. (Age 38) (RCA 1.8 RCM 16.1) Feb. 1929 to date with The Texas Co., Lands and Leases Div. Engr.

HENNES, ROBERT GRAHAM (Assoc. M.), Seattle, Wash. (Age 41) (RCA 5.7 RCM 5.0) Sept. 1934 to date with Univ. of Washington, since 1941 as Associate Prof.

HOBBS, MERRILL HOPKINS (Assoc. M.), Silver Springs, Md. (Age 51) (RCA 7.2 RCM 13.0) Jan. 1946 to date Superv. Engr., Hercules Powder Co, Baltimore, Md.; previously Chief Design Engr. and Architect, Mason & Hanger Co., New York City.

HUDGINS, HENRY CLAY, Bogota, Colombia. (Age 46) (RCA 8.9 RCM 9.5) Feb. 1942 to Oct. 1945 Mgr. and Pres., and Feb. 1944 to date Mgr., Henry C. Hudgins & Co., Bogota, Colombia; in the interim, unemployed; previously with Fred T. Ley & Co., Bogota, Branch.

HUMPHREY, CLEMENT EUGENE, Lombard, Ill. (Age 37) (RCA 7.2 RCM 8.4) Feb. 1946 to date Chf., Contracts and Constr. Div., Skidmore, Owings & Merrill, Architects-Engrs., Chicago; previously with U.S. Army, finally as Col.

KESSLER, LOUIS ROBERT, Toledo, Ohio. (Age 37) (RCA 1.2 RCM 13.5). March 1932 to date with Owens-Illinois Glass Co., since July 1946 associated with Vice-President F. T. Nesbitt.

LITTLE, JOHN GOULDING, San Francisco, Calif. (Age 66) (RCM 40.0) 1906 to date in private practice as Designing and Cons. Structural Engr., being member of firms, Barker & Little, Barker, Little & Hall, and J. G. Little & Co.

MACPHAIL, JEFFREY BURLAND (Assoc. M.), Montreal, Canada. (Age 51) (RCA 8.0 RCM 13.0) Jan. 1935 to date Senior Engr., Shawinigan Eng. Co., Montreal, Canada.

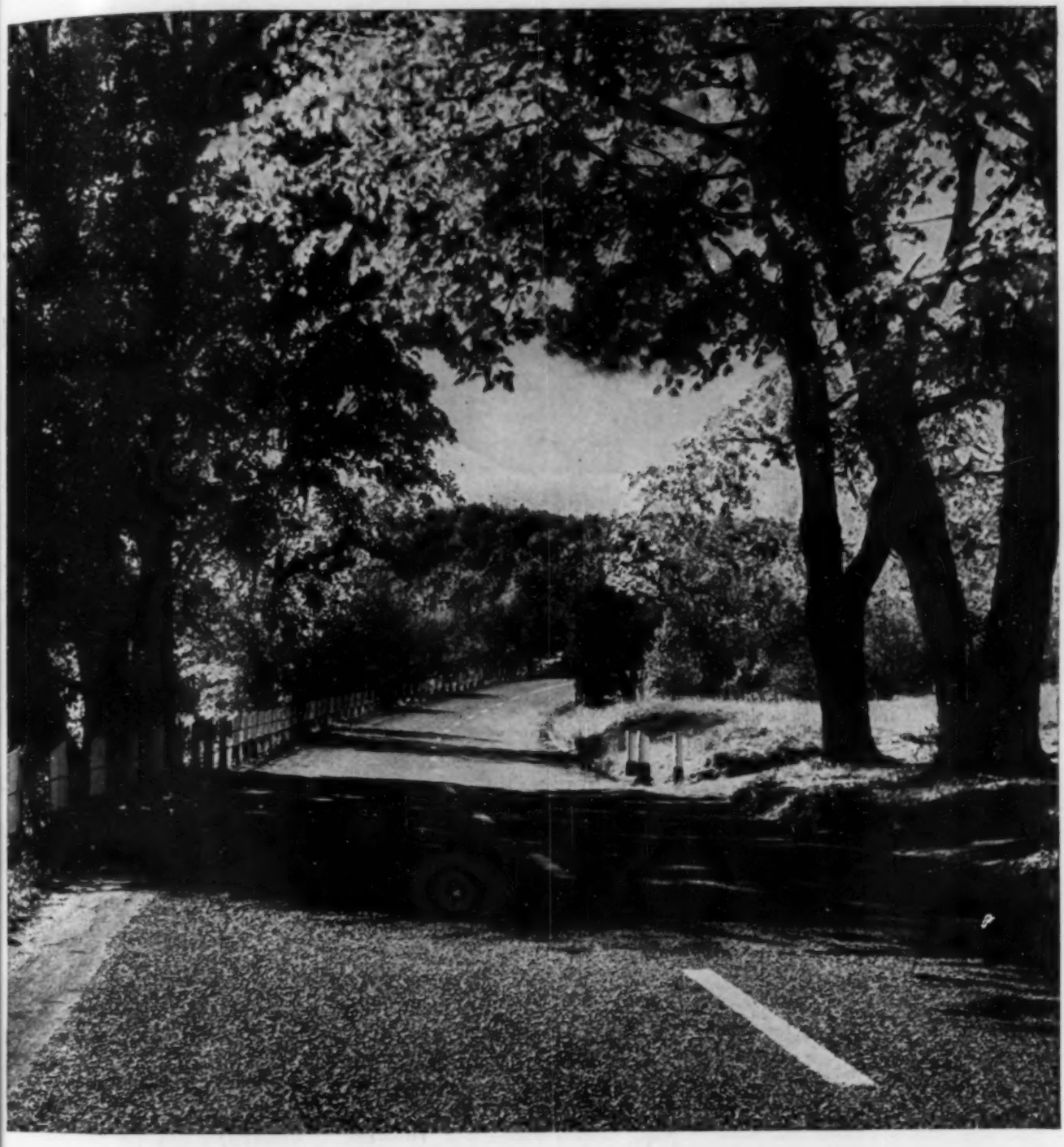
MCPHERSON, RALPH HARRISON (Assoc. M.) Greenville, S.C. (Age 36) (RCA 3.5 RCM 9.4) Nov. 1945 to date, member of firm, Structural and Civ. Engr., the McPherson Co., Greenville, S.C.; previously, Lt. (j.g.) and Lt., CEC, USNR; Civ. Engr., J. E. Sirrine & Co., Greenville, S.C.

MARTINE, FRANKLIN ARCHIE (Assoc. M.), Dallas Tex. (Age 37) (RCA 1.7 RCM 9.7) Feb. 1946 to date Chf. Engr. and Production Mgr., National Metal Products Co., Dallas, Tex.; previously, PA Engr. (R) (Capt.), U.S. Public Health Service; also Regional Designing Engr., FSA.

MEYER, NATHAN (Assoc. M.), Brooklyn, N.Y. (Age 42) (RCA 5.2 RCM 14.3) Oct. 1943 to date Chf. Engr., William Ginsburg Associates, New York City; previously, Designing Engr., M. W. Kellogg Co., New York City; Constr. and Proprietor, Hillside Constr. Co., New York City.

NEMETH, BLASE, Jacksonville, Fla. (Age 41) (RCA 6.9 RCM 11.6) Oct. 1941 to date with U.S. Engr. Office, Jacksonville, Fla., since Dec. 1944 as Executive Officer.

NICKEL, EDWARD AUGUST (Assoc. M.), Berkeley, Calif. (Age 49) (RCA 2.8 RCM 13.0) Jan.



1941 to date Structural Engr., Public Works Dept., 12th Naval Dist., San Francisco, Calif.

O'BYRNE, GERALDO GUILLERMO, Washington, D.C. (Age 38) (RCA 1.9 RDM 11.7) at present with American Road Bldrs., Washington, D.C.; previously with Ministry of Works, San Salvador.

ORR, WESTLEY LELAND, Santa Monica, Calif. (Age 40) (RCA 2.5 RCM 9.0) Sept. 1942 to date' Area Supervisor of War Training, and Associate Prof. of Eng., Univ. of California; previously Structural Designer, U.S. Engr. Office, Seattle, Wash.

PALMER, FRED ROBERT (Assoc. M.), Huntington, W.Va. (Age 37) (RCA 0.8 RCM 9.9) Jan. 1945 to date member of firm, Palmer & Henry, Gen. Contrs.; previously, Constr. Engr., Sammons Constr. Co., and Sammons & Daniel.

PENFIELD, WALLACE CLAY, Santa Barbara, Calif. (Age 41) (RCA 7.5 RCM 6.6) Aug. 1928 to date County of Santa Barbara, Calif., as Director of Planning and Public Works, etc., and at present County Surveyor.

PICKETT, BENJAMIN LINDLEY, Washington, D.C. (Age 38) (RCA 6.2 RCM 7.3) Sept. 1933 to Dec. 1939 and March 1946 to date with Bureau of Reclamation, since March 1946 Prin. Engr., Dept. of Interior, Washington, D.C., in the interim with U.S. Army finally as Col.

PRESCOTT CLARENCE HERBERT, Demarest, N.J. (Age 40) (RCA 10.0 RCM 6.0) Aug. 1929 to Jan. 1943 and Nov. 1945 to date with Shell Oil Co., Inc., since Jan. 1945 as Asst. Mgr., Eng. & Maintenance Dept.; in the interim, Lt., CEC, USNR.

RAIT, ROBERT ALEXANDER (Assoc. M.), Houston, Tex. (Age 35) (RCA 11.0 RCM 8.9) Dec. 1944 to March 1946 Senior Civ. Engr., and March 1946 to date Superv. Engr., Humble Oil & Refining Co., Houston, Tex.; previously, Project Engr., E. B. Badger & Sons Co., Boston, Mass.; with Ford, Bacon & Davis, Inc.

RANKIN, ELMER PAULL, Boston, Mass. (Age 50) (RCA 9.7 RCM 6.0) Oct. 1941 to date Structural Engr., V. S. Dist. Engr., War Dept., at Arlington, Va., and (since June 1942) Boston, Mass.

ROBERTSON, ROBERT EMMETT, JR. (Assoc. M.) Baltimore, Md. (Age 38) (RCA 4.3 RCM 5.3) Oct. 1941 to date with U.S. Army, since April 1944 as Major, Corp. of Engrs.

ROWAN, WILLIAM HAMILTON, Nashville, Tenn. (Age 42) (RCA 10.7 RCM 4.5) Sept. 1945 to date Associate Prof. of Eng., Vanderbilt Univ.; previously Lt., Lt. Commdr. and Commdr., USNR; with Tennessee Highway Dept.

SMITH, FRANCIS WILLARD, Ogden, Utah. (Age 55) (RCA 17.1 RCM 11.2) Aug. 1919 to date with U.S. Bureau of Public Works, Ogden, Utah, since July 1945 as Dist. Engr.

SMITH, FREDERICK CHARNLEY (Assoc. M.), Seattle, Wash. (Age 62) (RCA 12.4 RCM 5.0) 1926 to date with Univ. of Washington, since 1941 as Associate Prof.

VALLET, VICTOR EMIL, Detroit, Mich. (Age 53) (RCA 2.7 RCM 24.0) 1925 to date Pres., Giffels & Vallet, Inc., Detroit, Mich.

WALBRIDGE, SMITH STARR (Assoc. M.), New York City. (Age 40) (RCA 2.2 RCM 11.8) Sept. 1938 to date with Andrews & Clark, Cons. Engrs., as Engineer-in-Charge, Specifications, Estimates, and Utilities Secs.

WEIGLE, CARLYLE KNEPPER, Camp Hill, Pa. (Age 60) (RCA 15.8 RCM 21.8) July 1924 to date with State of Pennsylvania, since Sept. 1939 as Chf., Div. of Dams, Dept. of Forests & Water and Water Power Resources Board.

WENZEL, WILLIAM JULIUS, Great Falls, Mont. (Age 37) (RCA 3.9 RCM 6.3) Oct. 1943 to date with Corwin & Co., Inc., at present as Acting Chf. Engr.; previously with J. Gordon Turnbull and Sverdrup & Parcel, Edmonton, Alta., Canada; with Ellerbe & Co., St. Paul, Minn.

WETHERELL, DWIGHT NELSON, Chicago, Ill. (Age 57) (RCA 13.4 RCM 12.1) July 1944 to date Cons. Engr., Wells & Wetherell Cons. Engrs., Inc., previously Structural Engr., James Stewart & Co., Inc., Chicago; Designing Engr., Chicago Dept. of Public Works.

WILLCOMB, ROLAND HOWARD (Assoc.M.), Helena, Mont. (Age 61) (RCA 6.8 RCM 20.0) July 1941 to date with State Highway Comm. of Montana, since June 1946 as Administrative Aide and State Highway Engr. to Comm.

APPLYING FOR ASSOCIATE MEMBER

ANAYA, MARVIN, San Francisco, Calif. (Age 41) (RCA 7.4) March 1945 to date Civ. Engr. with City Engr., San Francisco, Calif.; previously San. Engr., Sewage Disposal Sec., Bureau of Eng., San Francisco.

AYDELOTT, WILLIAM WRIGHT, Fontana Dam, N.C. (Age 33) (R3A 2.9) Aug. 1936 to Sept. 1942 and Feb. 1946 to date with TVA, after Aug. 1941 as Associate Field Engr.; in the interim with U.S. Navy.

BARNES, WILLIAM WRIGHT, JR., Ft. Worth, Tex. (Age 31) (RCA 2.9) Feb. 1946 to date Designing Engr., Dept. of Public Works, Ft. Worth; previously with Corps of Engrs., U.S. Army.

BEASLEY, JON STANTON, Tallahasse, Fla. (Age 31) (RCA 1.0) March 1946 to date representing State of Florida on contracted aerial survey; previously with Corps of Engrs., U.S. Army; Party Chf.; Solomon & Keis, Engrs., Troy, N.Y.; Engr., Griffin Constr. Co., Atlanta, Ga.

BIDDLE CHARLES CHANDLER, State College, Pa. (Age 42) (RCA 4.7) Dec. 1945 to date graduate student, Pennsylvania State Coll.; previously, Lt. (j.g.) and Lt., USNR; with Pennsylvania Highway Dept.

BRANNAN, JOHN HAYES (Junior), Columbus, Ohio. (Age 27) (RCA 2.0 RCM 2.8) April 1946 to date Sales Engr., National Carbon Co., Inc., of New York City; previously with War Dept., Corps of Engrs., U.S. Army.

BROADHURST, EDWARD MARQUETTE, Jacksonville, Fla. (Age 43) (RCA 6.4) Dec. 1941 to July 1942 and Jan. 1946 to date Asst. Engr., U.S. Engrs.; in the interim, Ensign, etc., to Lt., USNR.

CARVER, WILLIAM ALFRED, San Jacinto, Calif. (Age 39) (RCA 6.6 RCM 1.7) April 1946 to date P–1 to P–4 Civ. Engr.; previously, San. Engr., San Bernardino Army Air Depot and Mobile Units; Asst. Supt., Thermal Operating Base, Yuma Air Base, Datelan Operating Base.

COSTALES, BERNARD RAOUL (Junior), Los Angeles, Calif. (Age 31) (RCA 2.6 RCM 0.3) June 1941 to date with U.S. Engr. Office, Los Angeles, Calif., since March 1944 as Associate Civ. Engr.

CRAFT, WELLING HALL, Tacoma, Wash. (Age 47) (RCA 13.9 RCM 4.7) April 1942 to date Office Engr., Strong & MacDonald and The MacDonald Bldg. Co.; previously in private practice.

DAILY, JAMES WALLACE, Pasadena 4, Calif. (Age 33) (RCA 3.0 RCM 4.8) Dec. 1935 to date with California Inst. of Technology.

DARBY, CLAUDE HAROLD, Vallejo, Calif. (Age 46) (RCA 14.1 RCM 4.9) Feb. 1946 to date Associate Bridge Engr., California Division of Highways, Bridge Dept. Design Section; previously with CEC, USNR, finally as Comdr.

DARNELL, MILLS JETT, Memphis, Tenn. (Age 32) (RCA 3.9) March 1946 to date Airport Engr., Municipal Airport, Memphis, Tenn.; previously Surveyor, Biscayne Eng. Co.; Asst. Airport Engr., Pan American Airways, Miami, Fla.; with CEC, USNR; with U.S. Engr. Office.

DAVIES, ARVON LLOYD (Junior), New York City. (Age 34) July 1946 to date with Raymond Concrete Pile Co., with U.S. Army; previously with CEC, USNR, finally as Lt. Commdr.; with Michigan Highway Dept.

DENHAM, GLENN ADAM, Little Rock, Ark. (Age 42) (RCA 4.7 RCM 7.4) Sept. 1941 to date with U.S. Engr. Office, since Feb. 1942 as Engr., at present at Little Rock, Ark., as Asst. to Head of Road & Utilities Sec.

DERMODY, JOSEPH LAWRENCE, Brooklyn, N.Y. (Age 30) (RCA 4.7 RCM 1.0) April 1943 to date with U.S. Public Health Service, since May 1945 as Senior Asst. Engr., Dist. 1, New York City; previously Project Engr., Wilputte Coke Oven Corp., New York City; Cost Engr., Semet Solvay Eng. Co.

DE SOUCY, ALLAN CHARLES, Dayton, Ohio. (Age 41) (RCA 6.7 RCM 7.7) Feb. 1939 to date with War Dept., Corps of Engrs., at present as Chf., Western Region and Southern Region Branches, Engr. Sec., Air Installations Div. Hq., Air Material Command, Wright Field, Dayton, Ohio.

DRAKE ALFRED C. (Junior), Blairstown, N.J. (Age 34) (RCA 2.7 RCM 2.4) March 1946 to date Field Constr. Engr. and (at present) Asst. Supt., The H. K. Ferguson Co.; previously, Area Engr., Hanford Engr. Works (Atomic Bomb Plant), Pasco, Wash.

EDEN, EDWIN WINFIELD, JR. (Junior), St. Louis, Mo. (Age 35) (RCA 3.9 RCM 4.6) June 1938 to July 1943 and Feb. 1946 to date with U.S. Engrs., since Feb. 1942 as Associate Civ. Engr., Upper Mississippi Valley Div.; in the interim with U.S. Navy.

FERNS, JOHN HAMILTON, Sacramento, Calif. (Age 38) (RCA 3.5) March 1946 to date Associate Civ. Engr., California Finance Dept., Sacramento; previously Asst. and Associate Bridge Engr., California Div. of Highways; with Ordnance Dept., U.S. Army; at Benicia (Calif.) Arsenal.

FRINCKE, HAROLD CARL, Knoxville, Tenn. (Age 39) (RCA 15.2) Sept. 1933 to date Landscape Arch., TVA.

GARD, WALTER SUMNER, Houston, Tex. (Age 35) (RCA 3.5) May 1941 to date with Brown & Root, Inc. Houston, Tex.; previously with Gulf Oil Corp.

GOVE, JOHN RAYMOND, Fayetteville, N.C. (Age 29) (RCA 3.4) at present graduate student, Univ. of North Carolina; previously with USNR.

GURNER, MARK STEPHEN, Washington, D.C. (Age 35) (RCA 8.0 RCM 4.3) Aug. 1935 to date with U.S. Engr. Dept., Jan. to July 1942 and Feb. 1946 to date as Senior Eng., previously Jun. and Asst. Engr.; July 1942 to Feb. 1946, 2d Lt. (Reserves), etc., to Col., Corps of Engrs., U.S. Army.

HILLMAN, FRANCIS THOMAS, JR., Galveston, Tex. (Age 38) (RCA 8.2 RCM 4.3) Sept. 1938 to April 1942 and Feb. 1946 to date with U.S. Engr. Office, after Dec. 1941 at Galveston (Tex.) Office; in the interim with U.S. Army, finally as Lt. Col., Civ. Engr. Corps.

JACOBY, GAINEY EDWARD, Grants Pass, Ore. (Age 28) (RCA 3.2) Dec. 1945 to date Asst. City Engr., Grants Pass, Ore.; previously w. Corps of Engrs., U.S. Army, finally as Major.

HOLT, CHARLES MCREYNOLDS, Ada, Okla. (Age 35) (RCA 7.0 RCM 1.8) Feb. 1946 to date Office Engr. with George C. Toler, Cons. Engr.; previously Carpenter's Mate 1st Class (Surveyor) U.S. Navy; with U.S. Engr. Dept.

JACOBY, GORDON CAMPBELL, Ridgewood, N.J. (Age 40) (RCA 13.6 RCM 1.0) Aug. 1945 to date Treas., Jacoby, McGrayne & Co., Paterson, N.J.; previously Designer, American Gas & Elec. Corp., New York City.

JAKIM, THEODORE JAMES, Cleveland, Ohio. (Age 31) (RCA 2.9 RCM 3.0) May 1946 to date with Standard Oil Co., Cleveland, Ohio; previously with Corps of Engrs., U.S. Army, finally as Bn. Commdr.

JOHNSON, NORMAN STANLEY (Junior), Fullerton, Calif. (Age 34) (RCA 7.1) May 1941 to Dec. 1945 Asst. Project Engr. and Project Engr. for Contrs., Pacific Naval Air Bases, Pearl Harbor; previously in Hydr. Engr's Office, City of San Diego, Calif.

JORDAN, JAMES WELLS (Junior), San Francisco, Calif. (Age 34) (RCA 2.6 RCM 8.4) June 1943 to date with USNR; previously Engr., Standard Oil Co., Calif.; previously Senior Engr., Walsh Driscoll Constr. Co., New York City.

KALMBACH, OLIN (Junior), Denver, Colo. (Age 33) (RCA 3.9 RCM 1.5) June 1935 to Oct. 1940, Sept. 1942 to Aug. 1943 and May 1946 to date with R. J. Tipton, Cons. Engr., R. J. Tipton & Associates and R. J. Tipton & Associates, Inc., Denver, Colo., finally as member of firm; in the interim, 2d Lt., 1st Lt. and Capt., U.S. Army, with The Panama Canal, Canal Zone.

KENISTON, FRANK MERTON (Junior), Coulee Dam, Wash. (Age 34) (RCA 3.9) July 1936 to April 1942 and Jan. 1946 to date with F. A. Banks, Coulee Dam, U.S. Bureau of Reclamation, at present as Field Coordinator and Job Engr.; in the interim, Lt., U.S. Army (overseas).

KOESSNER, ERWIN (Junior), Idaho Falls, Idaho. (Age 34) (RCA 1.9) Jan. 1936 to June 1941 and March 1945 to date with U.S. Bureau of Reclamation, since March 1945 as Civ. Engr. (P-3); in the interim, with CAA; with Siems, Drake, Puget Sound Co.

LARSEN, SAMUEL THORVALD, Newell, S.Dak. (Age 41) (RCA 7.0) April 1934 to March 1942 and June 1944 to date with U.S. Bureau of Reclamation, since Nov. 1945 as Project Supt., Belle Fourche project; in the interim, with The Austin Co., Oklahoma City, Okla.; with North American Aviation, Inc., Dallas, Tex.

LONG, WILLIAM FREDERICK (Junior), Billings, Mont. (Age 32) (RCA 2.3 RCM 4.9) June 1938 to May 1942 and Feb. 1946 to date with U.S. SCS, since Feb. 1946 as Soil Conservationist (Eng.); in the interim, 1st Lt., AAF.

MACKINNON, DONALD LAUCHLIN, Toronto, Canada. (Age 29) (RCA 5.9) March 1940 to Dec. 1941 and Feb. 1945 to date with Foundation Co. of Ontario Ltd., Toronto, Canada; in the interim, Student Univ. of Toronto; Royal Canadian Air Force; and Gunite & Waterproofing Co. Ltd. and Preload Co. of Canada Ltd.

MACRAE, WILLIAM BALE, CHICAGO, Ill. (Age 33) (RCA 2.6 RCM 1.5) Dec. 1940 to Feb. 1943 and Jan. 1946 to date with Federal Power Comm.; in the interim, Lt. (j.g.) and Lt., U.S. Navy.

MCDONALD, HENRY BURNSIDE, Baltimore, Md. (Age 34) (RCA 6.6 RCM 4.0) April 1941 to April 1943 and Feb. 1946 to date with J. E. Greiner Co., Baltimore, Md.; in the interim, with USNR.

MARTIN, WILLIAM COURTNEY (Junior), Bedford, Ind. (Age 29) (RCA 2.0) June 1942 to date Capt., Corps of Engrs., U.S. Army; previously Asst. Project Engr., State Highway Comm. of Indiana.

MEAD, THOMAS CHASE, Boulder City, Nev. (Age 55) (RCA 24.0 RCM 3.9) Aug. 1923 to date with Bureau of Reclamation, since Aug. 1944 as Engr., Grades P-3 to P-5, previously Assoc. Engr.

MORCH, JOHN VALDEMAR (Junior), Winchester, Mass. (Age 32) (RCA 2.0) Oct. 1941 to date Structural Designer, Stone & Webster Eng. Corp., Boston, Mass.

NEIGHBOURS, JOHN OWEN, JR., Baltimore, Md. (Age 30) (RCA 4.2) Jan. 1946 to date Designing Draftsman, Pennsylvania Water & Power Co., Baltimore, Md.; previously, Aug. 1944 to Jan. 1946, Operations Officer, Corps of Engrs., U.S. Army; Asst. Prof. of Military Science and Tactics, Univ. of Wisconsin.

ORDUZ, LUIS ENRIQUE, Bogota, Colombia. (Age 34) (RCA 0.3 RCM 9.3) Jan. 1943 to date Associate Prof. of Hydraulics, National Univ. of Colombia; previously member of firm and Chf. Engr., Orduz & Garcia Urbina, Bogota, Colombia.

PAGE, GORDON BENJAMIN (Junior), Alexandria, Va. (Age 35) (RCA 5.5) July 1940 to date with Corps of Engrs., U.S. Army, at present as Lt. Col., Office of Chf. of Engrs., Washington, D.C.; previously with U.S. Dept. of Agriculture.

POOLE, ARTHUR EDWARD (Junior), Long Island City, N.Y. (Age 33) (RCA 2.0 RCM 6.5) Feb. 1941 to date, Commdr. CEC, USNR; previously with Hallen Welding Co., Long Island City.

POWERS, SPENCER BYRD (Junior), Vicksburg, Miss. (Age 35) (RCA 7.5 RCM 1.9) Sept. 1940

to date with U.S. Army, at present on terminal leave, with Reservoir Constr. Div., U.S. Engr. Office, Vicksburg.

PYLE, JAY C., Little Rock, Ark. (Age 41) (RCA 5.2) May 1938 to date with U.S. Engr. Office, Little Rock, since July 1944 being Head, Hydrology Sec.

RICH, CHARLES CARLYLE, Santa Barbara, Calif. (Junior). (Age 34) (RCA 9.1) Sept. 1935 to July 1942 and Jan. 1946 to date with USDA, SCS, since Jan. 1946 as Associate Civ. Engr. (P-3); in the interim, with USED; with CEC, USNR, finally as Lt.

SKILES, JAMES WILLIAM, Pittsburgh, Pa. (Age 43) (RCA 7.3 RCM 1.0) July 1945 to date with C. H. Hunt Co., Cons. Engrs., Pittsburgh; previously with Armsler Morton Co., finally as Dept. Head.

SMOUSE, KENNETH JAMES (Junior), Ione, Ore. (Age 34) (RCA 3.5) Nov. 1938 to date with U.S. Geological Survey, since Oct. 1942 as Asst. Engr.; since Oct. 1943, managing wheat ranch.

STERNBERG, IRWIN, Tacoma, Wash. (Age 48) (RCA 18.3) Sept. 1920 to date with Washington State Highway Dept., since Sept. 1927 as Locating Engr. and Res. Engr.

STEVENSON, FRANK EUGENE, Vicksburg, Miss. (Age 36) (RCA 3.7 RCM 2.2) Jan. 1938 to Nov. 1940 and Feb. 1946 to date with U.S. Waterways Experiment Station, Vicksburg, Miss.; in the interim, with U.S. Army.

THORP, LLOYD THOMAS, Kansas City, Kans. (Age 34) (RCA 3.7) Feb. 1946 to date Concrete Design Engr., Jones-Hettelsater Constr. Co., Kansas City, Mo.; previously, U.S. Navy finally as Lt.; Designer Engr., Horner & Wyatt Engrs., Kansas City, Mo., with Prouty Bros. Eng. Co., Denver, Colo., with Giffels & Vallet, Engrs., Detroit, Mich.

THORSON, INGOLF EUGENE, Bremerton, Wash. (Age 32) (RCA 2.4) Oct. 1940 to date with Puget Sound Naval Shipyard, since Sept. 1945 as Structural Engr., Public Works Div.

TOWNER, JAMES MADSEN, Des Plaines, Ill. (Age 33) (RCA 1.1) Feb. 1946 to date with Industrial Sales Dept., United Gypsum Co., Chicago, Ill.; previously, Aircraft Instructor, CAC, U.S. Army; with Humble Oil & Refining Co.

TUTTLE, JAMES MASON (Junior), Knoxville, Tenn. (Age 31) (RCA 6.2) Nov. 1945 to date Designing Engr. with Frederic R. Harris Eng. Corp., Knoxville, Tenn.; previously, Capt., USMC, being Aerial Photographic Officer.

WALKER, JAMES KIRVEN, Dallas, Tex. (Age 32) (RCA 6.0) Feb. 1946 to date Office Engr. with J. J. Rady; previously, Lt., Capt., San Corps, U.S. Army; with George P. O'Rourke Constr. Co., Dallas, Tex.; with George P. Rice.

WIER, ROLLIN KIRTLEY (Junior), Denver, Colo. (Age 34) (RCA 2.7) Oct. 1942 to date Eng. Draftsman, Crocker & Ryan, Cons. Engrs., Denver, Colo.; previously, Eng. Draftsman, Sims, Drake, Puget Sound, Kodiak, Alaska; Draftsman, Colorado Highway Dept.

YODER, CHARLES WILLIAM (Junior), Milwaukee, Wis. (Age 35) (RCA 3.4 RCM 5.3) March 1945 to date Structural Engr., Portland Cement Association; previously, Structural Designer, Pennsylvania R.R., also Asst. Engr., Office of Chf. of Engineers.

APPLYING FOR JUNIOR

ALBORNOZ PLATA, EDUARDO, Bogota, Colombia. (Age 24) (RCA 1.5) Nov. 1945 to date student, graduate school, Univ. of Michigan; previously, San Engr., Dept. of Cundinamarca, Colombia.

BRADLEY, WILLIAM ARTHUR, Lansing, Mich. (Age 24) June 1944 to date with G. M. Foster, Cons. Bridge Engr., Lansing, Mich., as chf. of survey party, etc.; previously with Douglas Aircraft Co.

DADDARIO, DAVID JOSEPH, Long Island City, N.Y. (Age 27) (RCA 1.7) Feb. 1943 to March 1946 with U.S. AAF, after June 1945 as Post Utilities and Constr. Officer; previously Jun. Hydr. Engr., TVA, Knoxville, Tenn.

DANNENBAUM, PAUL JOHN, Scranton, Pa. (Age 26) (RCA 2.7) 1940 to 1941 Asst. Engr. and at present Engr., Standard Iron Works; in the interim, Engr., CEC, U.S. Navy.

DE VORE, WILFRED HENRY, Denver, Colo. (Age 28) April 1946 to date Engr. with Milo S. Ketchum, Denver, Colo.; previously Engr., Bridge Dept., Crocker & Ryan, Denver, Colo.; with Giffels & Vallet, Inc., Detroit, Mich.

EWING, JOSH P., JR., Houston, Tex. (Age 25) Dec. 1943 to May 1946 Eng. Officer, U.S. Navy, on a destroyer.

GONZALEZ, M. MARCELO, Merida, Venezuela. (Age 22) Jan. 1946 to date Prof., Univ. of de Los Andes in Merida; previously, Eng. Asst., La Cindad Univ., Caracas; Designer, Jahn Bidrs., Caracas.

GUREWITZ, MILTON ALLEN, Washington, D.C. (Age 28) Feb. 1944 to date with USNR, at present as Lt. (j.g.) CEC; since Dec. 1945 being Head, Public Works Planning Div., Bureau of Yards & Docks; previously with U.S. Engr. Dept.

GUZMAN, JOSEPH SATURN, Los Angeles, Calif. (Age 28) March 1946 to date Jun. Engr., Pacific Elect. Ry. Co., Los Angeles, Calif.; previously S/Sgt., Corps of Engrs., U.S. Army.

HAMLYN, RICHARD LOUIS, Phoenix, Ariz. (Age 25) April 1946 to date Designer and Draftsman, Stephens & Hamlyn, Phoenix, Ariz.; previously, Senior Office Asst., Texas Highway Dept., El Paso, Tex.

HERRS, ALFREDO MANUEL, Santurce, Puerto Rico. (Age 21) Nov. 1945 to June 1946 graduate student, Univ. of Michigan; previously Asst. Design Engr., Puerto Rico Aqueduct Service.

HUSTVEDT, ANDERS OTIS, Syracuse, N.Y. (Age 27) Jan. 1946 to date graduate student (fellowship) at Maxwell Graduate School, Syracuse Univ.; previously with Dravo Corporation; with E. I. du Pont de Nemours & Co. as Junior Engineer and Draftsman.

KELLEY, STANLEY ROBERT, College Station, Tex. (Age 31) (RCA 2.8) July 1938 to date with U.S. Engrs., since Dec. 1945 as Lt. Col., Corps of Engrs., U.S. Army; at present assigned to Texas Agricultural & Mechanical Coll. as graduate student.

TENNEY, VERN WILLARD, Berkeley, Calif. (Age 28) Dec. 1942 to date with CEC, U.S. Navy, since April 1945 as Lt.; previously, Jun. Engr., U.S. Engrs., War Dept.; Jun. Structural Design Engr., Lockheed Aircraft Corp.

VASQUEZ, CARLOS, Bogota, Colombia. (Age 28) (RCA 2.3) Dec. 1945 to date Visiting Engr. Dept. of Power Plants, Colombia; previously, Jun. Exploitation Engr., Shell Oil Co., Colombia.

1941 GRADUATES

UNIV. OF MD. (B.S.C.E.)

	Age
JENSEN, WILLARD CECILLIUS	(29)

VA. MIL. INST. (B.S.C.E.)

DOBYNS, SAMUEL WITTEN	(26)

UNIV. OF WASH. (B.S. in C.E.)

HAIG, NEIL, JR.	(27)

1942 GRADUATES

GA. SCHOOL TECH. (B.S.C.E.)

CROMARTIE, WILLIAM DOUGLAS	(26)

LEHIGH UNIV. (B.S.C.E.)

LULEY, HOWARD GEORGE	(29)

UNIV. OF OKLA. (B.S.C.E.)

HENDERSON, WILLIAM GARTH	(27)

VA. MIL. INST. (B.S. in C.E.)

MILLER, CHARLES BRUCE	(25)

1943 GRADUATES

STANFORD UNIV. (B.A. in C.E.)

HILL, RALPH OWEN	(25)

VA. MIL. INST. (B.S. in C.E.)

WELTON, FRANCIS CONWAY	(26)

1944 GRADUATES

MANHATTAN COLL. (B.S.C.E.)

BURKE, EDMUND JOSEPH	(24)

MASS. INST. TECH. (S.B.)

FARMER, FRANKLIN RALPH	(23)

1945 GRADUATES

UNIV. OF CALIF. (B.S.C.E.)

ROHDE, ERLING WHITE	(22)

UNIV. OF CIN. (B.S. in C.E.)

ANDEREGG, RUPERT ANDREW, JR.	(23)

COOPER UNION (B.S.C.E.)

LEVY, LAWRENCE	(20)

NORTHWESTERN UNIV. (B.S.C.E.)

WENGER, LOUIS AARON	(20)

1946 GRADUATES

CALIF. INST. TECH. (B.S.C.E.)

GUZMAN, JOSE DANIEL CORTES	(23)
SCHNEIDER, JEROME WILLIAM	(21)

UNIV. OF CALIF. (B.S. in C.E.)

GIERLICH, JAMES OSWALD	(20)

CATHOLIC UNIV. OF AMERICA

MARCHIGIANI, ALVIN FRANCIS	(21)
REXACH, FELIX BENITEZ, JR.	(20)

COLO. STATE COLL. (B.S. in C.E.)

JOCHIM, LA VERGNE CLAUDE	(23)
SIMPSON, WILLIAM MERLIN	(23)

COOPER UNION (B.S.C.E.)

GORKY, HENRY MICHAEL	
TURBIAK, WALTER MICHAEL ALBERT	(21)
WIDMER, WILBUR JAMES	(23)
	(27)

CORNELL UNIV. (B.C.E.)

KENDRICK, EDWARD JOSEPH	(24)
WRIGHT, DOUGLAS LYMAN	(26)

UNIV. OF DETROIT (B.C.E.)

WEINBERG, LESTER HARRY	(23)

UNIV. OF IDAHO (B.S. in C.E.)

EIDE, GERALD HERMAN	(30)

UNIV. OF ILL. (B.S.C.E.)

BREDOW, PAUL FREDERICK	(21)
COLIN, EDWARD CECIL, JR.	(20)
DANFORTH, HERMAN LEONARD	(21)
DOLAN, MAURICE JOSEPH	(20)
DOPPS, WILLIAM DAVID	(21)
FEE, JOHN MACKEY, JR.	(20)
FRANK, NEAL HENRY	(27)
HALVAMA, EUGENE ERNEST	(20)
HOSKINS, DALTON	(20)
HUFF, GEORGE ALLEN	(20)
JOHNSON, ROY ISADORE	(21)
LAKIN, MYRON KEITH	(20)
LATIMORE, WILLIAM SPEARS, JR.	(21)
MOORE, CHARLES DEE	(24)
MOSBORG, ROBERT JOHN	(21)
NIEMAN, HUBERT WILLIAM	(20)
RANEY, CARROLL STANLEY	(20)
ROGERS, LAWRENCE W.	(21)
SIKKEMA, WILLIAM MILFRED	(20)
SMITH, DONALD HILTON	(20)
STADE, CHARLES EDWARD	(21)
SWETS, DONALD HENRY	(20)
WIEDOW, ROY WALLACE, JR.	(21)
WOFFORD, THOMAS DEWITT, JR.	(20)

UNIV. OF KY. (B.S.C.E.)

TURNER, GEORGE REDMAN, JR.	(21)

UNIV. OF KANS. (B.S.C.E.)

PHELPS, HAROLD BARTLE	(21)

MASS. INST. TECH. (S.M.)

MARTIN, RONALD FRANCIS	(27)
(also, 1942, B.S.C.E., Nova Scotia Tech. Coll.)	

MO. SCHOOL OF MINES & MET. (B.S. in C.E.)

MANN, ROBERT LIVINGSTON	(20)

UNIV. OF MO. (B.S.C.E.)

MCGLOTHLIN, JOE WILLIAM	(20)
PRATT, CHARLES LIEURANCE	(20)

UNIV. OF NEW MEX. (B.S.C.E.)

ALLEN, GEARY M., JR.	(22)
BURROWS, GEORGE CARLTON, JR.	(23)

N.C. STATE COLL. (B.S.C.E.)

MIZELLE, MERRIMOND BROWN	(20)

NORTHEASTERN UNIV.
(B.S.C.E.)

BARNES, BERNARD ADAIR. (22)
CAMPBELL, JOHN MACFAYDEN (22)
ESCHELBACH, CARL WILLIAM (22)
LOWELL, DAVID INGRAHAM (20)
PALMER, KENNETH EARL (23)
SAVAGE, WILLIAM EDWARD, JR. (31)

UNIV. OF OKLA.
(B.S.C.E.)

CHADWICK, DEAN ORVILLE (21)
CURTIS, HOWARD BENTON, JR. (22)
LEDBETTER, DONALD LEE (20)
RICHARDSON, JOE ALTON (22)
VOGEL, ALBERT MOEHE (24)

PURDUE UNIV.
(B.S. in C.E.)

BUSH, ROBERT YOUSE (21)
CUNNY, ROBERT WILLIAM (22)
CURTIS, KENNETH STEWART (20)
DOUGLASS, ROBERT THOMAS (29)
EARLE, SAMUEL WILLIAMS (22)
GAEBEL, ELDON LEROY (21)
GWOSDOW, MARTIN LIONEL (23)
KESSLER, LESTER ALVIN (21)
LUEDEKING, ERNEST WILLIAM (20)
MONTGOMERY, PAUL LEWIS (23)
MUMMERT, JAMES ALLEN (29)
O'DAY, DANIEL JAMES (22)
OWENS, CLIFFORD WAYNE, JR. (20)
PIETTE, JAMES MARTIN, JR. (21)
RAMPE, DAVID ALFRED (22)
SHERMAN, WALTER CHARLES (21)

RUTGERS UNIV.

CESTONE, RALPH MICHELE (22)

UNIV. OF SO. CALIF.

BROWNING, GLEN EARL (26)
NICHOLS, ROBERT LELAND (20)
ROETHER, RICHARD WELLBORN (29)
SALMEN, FREDERICK JULES (21)
TAYLOR, HOWARD LEIBERT (24)
WYSS, GERARD ADOLPH (33)

UNIV. OF S.C.
(B.S.C.E.)

AKEL, MAJED A. (20)

STANFORD UNIV.
(B.S. in C.E.)

HOAGLAND, WILBUR WRIGHT, JR. (21)
OLSON, JOHN LOUIS (20)
PAKBOY, ALI (28)
RISLING, WESLEY DELMAR (21)
THOMPSON, OSCAR ALBIN (23)

SWARTHMORE COLLEGE
(B.S.C.E.)

AGLER, ROBERT DEAN (22)
CHRISTIE, RUSSELL WILLIAM (22)
DE WITT, FREDERICK WHITFIELD (21)
DUKE, ALAN LOUIS (21)
HAYS, WILLIAM WARD (21)
JACOBS, HERBERT WARREN (21)
KOBLANSKI, MICHAEL GEORGE (21)
LENGYEL, ALBERT (22)
MCCALLUM, HUGH HAYNESWORTH, JR. (21)
MCHUGH, NOBLE TYRUS (21)
MARTIN, ABRAHAM WILLIAM (25)
NOLIN, GERALD EMILE (23)
STOLL, ROBERT FRANKLIN (21)
YEARKE, LAWRENCE WILLIAM (21)

TEXAS A. & M. COLLEGE

FARROW, JOE PERRY (32)
URBINA, MARIO (21)

TUFTS COLLEGE
(B.S.C.E.)

BARKAN, BENEDICT GUNTER (21)

UNIV. OF UTAH
(B.S. in C.E.)

PAULSEN, FINN BERGSTEDT (26)

VANDERBILT UNIV.
(B.E.)

LEE, THOMAS BURNS (20)

VA. MIL. INST.
(B.S.C.E.)

POTTS, ALLEN RIVES (24)

YALE UNIV.
(B.S. in C.E.)

KUESEL, THOMAS ROBERT (20)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

RECENT BOOKS

New books donated by the publishers and filed in the Engineering Societies Library, or in the Society's Reading Room. Notes regarding books are taken from the books themselves, edited by the staff of the Society or of the Library. Books in the Library may be borrowed by mail by Society members for a small handling charge.

ARCH DESIGN SIMPLIFIED. By W. A. Fairhurst. Concrete Publications Ltd., London, 1945. 61 pp., illus., diagrs., charts, tables, $9^1/_4 \times 6^1/_2$ in., cloth, 12s. The object of this book is to present a simple, practical method for the design of economical fixed arches. Part I deals briefly with the choice of the arch curve. The design tables in Part II are based on arch curves set out to coincide with the pressure line for dead loading plus half the distributed live load. Parts III and IV give practical examples of design and the theory and derivation of the formulas involved.

(THE) DESIGN OF REINFORCED CONCRETE STRUCTURES, 2 ed. By D. Peabody. John Wiley & Sons, New York; Chapman & Hall, London, 1946. 532 pp., diagrs., charts, tables, $8^3/_4 \times 5^1/_2$ in., cloth, $5.50. Although this book is primarily concerned with the design of buildings, these fundamentals of structural design in reinforced concrete are applicable as well to other classes of structures. The several phases of structural theory are accompanied by illustrative problems which collectively form the essentials for the design of a complete building. This new edition includes "plastic theory," pre-stressed concrete, rigid-frame design, and special conditions of beams and continuous frames. Matters of construction details and manipulation have not been considered within the scope of the book.

DESCRIPTIVE GEOMETRY. By E. F. Watts and J. T. Rule. Prentice-Hall, Inc., New York, 1946. 301 pp., illus., diagrs., charts, tables, $9^1/_4 \times 6$ in., cloth, $3. The theory of descriptive geometry is fully developed as a basis for the solving of engineering problems by graphical methods. Separate chapters are appended, dealing with precision in drawing, properties of plane figures, and stereoscopic drawing. Problems illustrate each chapter.

FUNDAMENTALS OF THERMODYNAMICS. By A. S. Adams and G. D. Hilding. Harper & Brothers, New York and London, 1945. 280 pp., diagrs., charts, tables, $9^1/_2 \times 6$ in., cloth $3.75. The object of the authors is to give the beginning student an understanding of the fundamentals of thermodynamics adequate for further related study in mechanical engineering, physics, and chemistry. Separate chapters are devoted to compressed air, the Otto and Diesel cycles, and steam cycles. Many worked-out practical examples are included.

LE BOIS, MATÉRIAU DE LA CONSTRUCTION MODERNE. By J. Campredon, preface by M. Leloup. Dunod, Paris, 1946, 153 pp., diagrs., charst, tables, $8^1/_4 \times 5^1/_4$ in., paper, 240 frs. The author first deals with the structure and physical properties of wood. He then describes various methods of treatment of wood to increase its value as a structural material, such as impregnation, compression, and lamination. The last section covers the new uses for which wood has been made available, such as built-up beams, and sections formed by the application of heat and pressure.

MANUAL FOR WATER PLANT OPERATORS. By A. A. Hirsch. Chemical Publishing Co. Brooklyn (N.Y.), 1945. 386 pp., illus., diagrs., charts, tables, $8^1/_4 \times 5^1/_4$ in., cloth, $6.50. Written for the practical man, this book gives a comprehensive picture of correct operating practice in clear and simple style. The several sections cover, respectively, the sources and procurement of water; basic methods of water treatment; special treatment methods; the distribution system; and control tests. A miscellaneous section covers emergencies, records, and data tables, and there is a brief bibliography.

NEW CITIES FOR OLD. By L. Justement. McGraw-Hill Book Co., New York and London, 1946. 232 pp., illus., diagrs., charts, tables, $10^1/_4 \times 7$ in., cloth, $4.50. Part I presents a study of urban growth and decay as a basis for city planning within the limitations of a system of private enterprise. It poses certain problems and suggests possible solutions. In Part II the city of Washington, D.C., is utilized as an example to demonstrate the kind of city planning put forth in this book. In Part III, with the political background as a frame of reference for urban reconstruction, the author outlines his conception of a workable, integrated solution of the problems discussed in Part I, including the financial and legal aspects.

PERSONALITY AND ENGLISH IN TECHNICAL PERSONNEL. By P. B. McDonald. D. Van Nostrand Co., New York, 1946. 424 pp., $9^1/_4 \times 5^1/_2$ in., cloth, $3.75. This book emphasizes the importance of developing a definite personality, an accurate command of English, and effective methods for presenting ideas, both written and verbal, with specific suggestions for improvement in these particulars. The value of a reasonably broad cultural as well as technical background is brought out, and several chapters offer material for increasing one's general knowledge.

(A) RAILROAD FOR TOMORROW, 1960, limited first edition. By E. Hungerford. Kalmbach Publishing Co., Milwaukee (Wis.), November 1945. 323 pp., illus., tables, $9^1/_4 \times 6$ in., cloth, $5. The unification of the railroads of the United States into one system is the theme of this book. In semifictional style the author describes in detail the steps by which this was accomplished under the direction of one William Wiggins. A thorough historical treatment of American railroads to the present day is included, together with the hypothetical developments up to 1960, by which date the unification is presumed to be complete. The work is a well-reasoned and thought-provoking study for all those who are interested in railroads and transportation problems.

(THE) REYNOLDS' NUMBER. By J. Jennings. Emmott & Co., Ltd., Manchester (England), 1946. 20 pp., charts, tables, $7^1/_4 \times 4^1/_2$ in., paper, 1s. The object of this small pamphlet is to demonstrate clearly the meaning of the Reynold's Number, to examine its structure, explain its significance, and show how it may be calculated and utilized. The pamphlet should be useful to any one concerned with any of the varied applications of the science of fluid dynamics.

RUBBER IN ENGINEERING. Prepared under the direction of the Controller of Chemical Research of the Ministry of Supply and the Directors of Scientific Research of the Ministry of Aircraft Production and the Admiralty on the Basis of Research carried out by the Imperial Chemical Industries, Ltd. Chemical Publishing Co., Brooklyn (N.Y.), 1946. 267 pp., illus., diagrs., charts, tables, $8^1/_4 \times 5^1/_2$ in., cloth, $5.50. Part I, describing the rubber-like state, and Part II, discussing the general properties of rubber, furnish engineers with a general survey of the information available on the theoretical aspects of the subject. Part III provides useful information on the compatibility and incompatibility of rubber properties in their relation to practical use, covers the bonding of rubber to metal, and discusses other aspects of rubber technology. Part IV deals at some length with the principles of the design of rubber engineering components for shock absorption, vibration insulation, etc.

SCIENCE IN A CHANGING WORLD, rev. ed. By E. J. Cable, R. W. Getchell, and W. H. Kadesch. Prentice-Hall, Inc., New York, 1946. 622 pp., illus., diagrs., charts, maps, tables, $9^1/_4 \times 6$ in., cloth, $5. Intended for the general reader, this book presents the basic facts of the physical sciences in simple language. For each scientific principle the authors give an example from the range of everyday living. Beginning with weights and measures and the first simple machines, the book deals successively with physics, climatology, chemistry, geology and astronomy, including the allied fields. The revised edition includes such recent topics as atomic fission, radar, and the electron microscope.

SHEET PILING, COFFERDAMS AND CAISSONS. By D. H. Lee. Concrete Publications Ltd., London, 1945. 191 pp., illus., diagrs., charts, tables, $9^3/_4 \times 6^1/_2$ in., cloth, 10s. The first two chapters of this book on deep foundation work cover sheet piling and the earth pressures involved. The design and construction of cofferdams are given in Part III, with the next three parts devoted to the theory and practical application of cylinder and both open and pneumatic caissons. A brief note on box caissons as breakwaters is included. Construction details are effectively diagrammed, and examples have been selected to emphasize reasons for choosing certain types or methods.

STATICALLY INDETERMINATE STRUCTURES. By L. C. Maugh. John Wiley & Sons, New York; Chapman & Hall, London, 1946. 338 pp., diagrs., charts, tables, $9^1/_4 \times 5^3/_4$ in., cloth, $5. Following the classification and description of statically indeterminate structures, this book explains and illustrates methods of analysis of these structures with emphasis on methods of successive approximation. These methods are based on fundamental principles of structural mechanics that are applicable to the design of most frame structures. Special problems dealt with are frames with semi-rigid connections, the calculation of stresses in space frames, and shearing stresses in thin-walled closed sections.

TRACK AND TURNOUT ENGINEERING. By C. M. Kurtz. Simmons-Boardman Publishing Corporation, New York (30 Church Street), 1946. 461 pp., diagrs., charts, tables, $7^1/_2 \times 4$ in., cloth, $5. This manual is a revised and enlarged edition of "Modern Location of Standard Turnouts," which was published in 1910 and 1927 and is now out of print. The present volume deals with design details of railroad turnouts and crossings and gives mathematical treatments of track layouts and connections.

Engineering Societies Personnel Service, Inc.

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A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription of $5 per quarter or $10 per annum, payable in advance.

MEN AVAILABLE

CIVIL ENGINEER; Assoc. M. ASCE; experienced in engineering research, report writing, and editing; excellent writer; good knowledge of French; 10 years' public relations with diplomatic experience in Washington; 4 years in U.S. Corps of Engineers, Military Intelligence Division. Seeks position in technical writing, research, or editing, or in organizational or related work. Good personality. C-289.

ARCHITECTURAL ENGINEER; Jun. ASCE; age 28; graduated in 1940; 4 years with CEC, U.S. Navy, as maintenance officer on shore bases, including airports. Previously with War Department—design of military air bases. Qualified and interested in small firm, engineers, builders, or direction maintenance institution or small municipality. C-290.

SANITARY ENGINEER; Jun. ASCE; age 27; single; M.S. in sanitary engineering; 18 months' experience with State Health Dept. Recently discharged as Lt. (jg) after 3 years in U.S. Navy—last 6 months in Public Works Water Department. Location preferred, West. Available immediately. C-291.

CIVIL ENGINEER; Jun. ASCE; 34; married; 11 years' experience, including experimental hydraulics, housing (planning, construction, and management), public works, public utilities, and transportation; 5 years in CEC, U.S. Navy. Desire permanent position. Location immaterial, if suitable quarters available. C-292.

CIVIL ENGINEER—PERSONNEL ADMINISTRATION; Jun. ASCE; B.S.C.E.; 31; married; 6 years on construction and maintenance of pipe line, oil field, service station, and 13,000-barrel refinery; 4 years as editor of safety and employee relations magazine; 4 years in Naval aviation personnel administration—now Lt. Comdr., line, Naval Reserve. Available on or about September 1, 1946. C-293.

CIVIL OR HYDRAULIC ENGINEER; Assoc. M. ASCE; 37; married; former major, U.S. Corps of Engineers; 5 years on hydrologic research, drainage, and flood control design and survey, flood-frequency and unit hydrograph investigations; 5 years' topographic experience in aerial photogrammetry, including compilation, drafting, and surveying; 6 years general highway engineering, design, construction, and surveying. Executive, organizing, and training ability. Available immediately. Location preferred, West Coast. C-294.

CIVIL ENGINEER; Jun. ASCE; graduate of University of Texas; veteran; experience in construction work as an estimator, purchasing agent, and field engineering. At present with R. E. McKee of El Paso, Tex., general contractor. Willing to go out of the States. Desire position with a general contractor with opportunity to advance on merit. C-295.

CIVIL ENGINEER; Jun. ASCE; 28; married; now Lt., CEC, USNR; B.S.C.E., 1942; 2½ years in Construction Battalions on roads, airfields, forward area installations, planning, and construction; 1½ years on supervision of maintenance permanent shore bases; 3 years in semi-pro work on maintenance of railroads, buildings, and grounds. Desire position with future. Available August 15, 1946. Location preferred, Rocky Mountains, Pacific Coast, or Alaska. C-296.

CIVIL ENGINEER; Jun. ASCE; 27; B.S. and M.S. in C.E., Lehigh University; 2 years' experience in structural research; 6 months as structural draftsman; 1 year teaching at engineering college; know German, Russian, and French; have just returned from responsible Military Government position in Berlin; financial experience; desire position with future. C-297.

CIVIL ENGINEER; Jun. ASCE; 22; married; B.C.E., Cornell University, with honors; experience on design of reinforced concrete and structural steel. Will travel. Will consider foreign location. C-298.

CIVIL ENGINEER; Jun. ASCE; 31; now overseas as captain, Sanitary Corps, A.U.S.; discharge expected in September 1946. Licensed professional engineer, New York; graduate; 10 years' varied experience in planning, design, and construction of water works, sewerage, flood control works, highways, industrial and domestic buildings. Desire connection with consulting or construction firm in New York City area or Washington, D.C. C-299.

ENGINEER MANAGER; Jun. ASCE; C.E. degree; 36; Commander, U.S.N. Construction Battalions, public works executive. Registered professional engineer, experienced in supervision of design, construction, and maintenance of large institutional and industrial facilities. C-300.

POSITIONS AVAILABLE

ASSISTANT MUNICIPAL ENGINEER, preferably civil graduate, with some experience, for surveying, drafting, and layout of buildings, streets, sewers, etc. Home building inspection experience desirable. Salary, $2,400–$2,880 a year. Location, northern New Jersey. W-6557. Reopened.

CONSTRUCTION SUPERINTENDENT, under 50, with at least 10 to 15 years' experience on small homes development. Salary, $6,000 a year. Location, northern New Jersey. W-6728. Reopened.

ENGINEERS. (*a*) Cost Engineer, 35–45, with construction experience covering labor, materials, and equipment, for field assignment on heavy construction. Location, Venezuela and Colombia. Salary $4,800 a year, plus subsistence. (*b*) Senior Cost Engineer, 35–50, with heavy construction experience covering cost control, cost analysis, etc., to supervise job costs and estimates in general office. Salary, $4,800 a year. Location, New York, N.Y. W-7220.

CIVIL ENGINEERS, reporting single status. (*a*) Civil Engineer, graduate, preferably with construction experience. (*b*) Engineer, technical graduate, with experience in construction of streets, sewers, water supply, and housing. Two-year contract. Location, Colombia. W-7344.

INSTRUCTOR OR ASSISTANT PROFESSOR of civil engineering, graduate, to teach courses in stresses, theory of structures, reinforced concrete, and steel, etc., or hydraulics, fluid mechanics, water supply, and sewerage, and such other elementary courses as required. Must have had 2 years' surveying experience. Salary, $2,600–$3,500 a year. Position starts in September 1946. Location, Michigan. W-7368 (*b*).

FIELD SUPERINTENDENT, 35–45, with experience, to take charge of planning and direction of maintenance, operation of income-producing facilities, and some construction work in public parks. Experience in maintenance of large country estate helpful. Permanent. Write giving full details of personal and experience data. Location, New York Metropolitan Area. W-7373.

MUNICIPAL ENGINEER, 35–45, for maintenance of water and sewer systems, roads, etc.; supervision of maintenance and rental of housing proj-

...AND A BIG JOB GETS *all the air it needs*

This story concerns an air compressor used indoors. It tells how a G-E motor enabled the compressor to fit into a very tight space. But it applies equally well to users of air compressors on outdoor construction jobs where portability and ease of handling are important.

Back in 1943, engineers of an eastern industrial concern found that unless they could increase their compressed-air capacity quickly, vital war production was going to fall behind schedule. The problem was—where to put an extra air compressor in a plant already jam-packed with machinery.

There was just one empty corner about 10 by 12 feet in area. A compact high-speed air compressor might be squeezed in. But that left no room for a belt- or shaft-connected drive-motor. The answer was a motor that could be mounted right on the compressor—an unusally compact, close-coupled synchronous motor.

Today, both the compressor and its G-E motor can boast of a perfect three-year performance record, and the combination is still going strong. It has never failed to meet a sudden increase in compressed air demand, and has operated throughout every night shift with no more maintenance than routine inspection and lubrication.

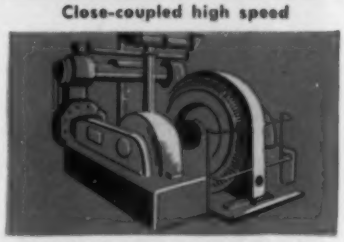
Close-coupled for Economy

G-E close-coupled synchronous motors have won wide acceptance among compressor users in the construction field. Because the rotors are precision fitted directly to the compressor crankshaft, these motors need no outboard bearing or separate foundation. The motor air gap is uniformly and permanently maintained. Installation is simple, too—it is easy to align the motor flange with the compressor frame.

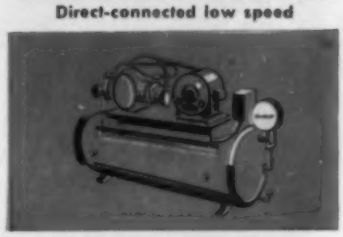
Whether you make compressors or use them, you will be interested in the design and maintenance savings made possible with compact G-E synchronous motors. Write or phone your nearest G-E office. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

G-E SYNCHRONOUS MOTORS FOR COMPRESSORS

Close-coupled high speed



Direct-connected low speed



Belt-connected Tri-Clad

GENERAL ELECTRIC

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ects, together with several commercial store properties. Should have knowledge of general business practice and real estate management and development. Salary, $6,000–$18,000 a year. Housing available. Location, New York Metropolitan area. W-7401.

STRUCTURAL DRAFTSMAN, civil graduate to lay out conveyors and structural supports; also some design of reinforced concrete. Salary, $3,000–$4,200 a year. Location, New York, N.Y., with occasional traveling. W-7418.

STRUCTURAL ENGINEER with knowledge of design of foundations, structural steel, and reinforced concrete. Should be able to make cost estimates and have sufficient construction experience, to handle construction projects in the field. Salary, about $6,000 a year. Location, Connecticut. W-7485.

STRUCTURAL ENGINEER, graduate preferred, with 5 to 10 years' experience in structural design, to design foundations and structural frame work—that is, retaining walls, culverts, power stations, etc. Will do own drafting. Salary open. Location, Pennsylvania. W-7441.

ENGINEER, young, to assist in design of steel and concrete structures—that is, dams and locks. Should have had experience in concrete and steel structures making pipe and machinery layouts. Salary, $3,300 a year. Location, Florida. W-7445.

ENGINEER, 25–30, graduate preferred, with experience in structural design and detailing, foundation design, material handling, equipment layout, and piping layout. Salary, $3,500–$4,000 a year. Location, Florida. W-7456.

RESIDENT MANAGER, preferably veteran, with experience in real estate management, to be owner's representative during construction period and to supervise operation and maintenance of housing project afterwards. Salary, $5,000 a year. Location, New York, N.Y. W-7459.

ASSISTANT PROFESSOR AND INSTRUCTOR of civil engineering. (a) Assistant Professor with several years' experience in some phase of hydraulic or sanitary engineering work, to take charge of courses in hydraulics, water supply, and sewerage. Salary, $2,900–$3,500. (b) Instructor with some engineering experience, to teach courses in applied mechanics and related courses. Salary $2,000–$2,800. Positions start in September 1946. Location, Pennsylvania. W-7479.

Current Periodical Literature

Abstracts of articles on civil engineering subjects from publications (except those of the American Society of Civil Engineers) in this country and foreign lands. The articles indexed are on file in the Engineering Societies Library, 29 West 39th Street, New York, N.Y. Photoprints will be supplied by this Library at the cost of reproduction, 25 cents per page to members of the Founder Societies (30 cents to all others), plus postage, or technical translations of the complete text may be obtained at cost.

BRIDGES

CAST IRON, MAINTENANCE AND REPAIR. La réparation du viaduc en fonte sur le Rhone, entre Tarascon et Beaucaire, E. Fougea. *Génie Civil*, vol. 123, no. 3173, Jan. 15, 1946, pp. 17–20. Illustrated description of repair of cast-iron bridge over Rhone River between Tarascon and Beaucaire, France; two of its seven 60-m arches were destroyed and three were damaged during war; transverse and longitudinal sections and technical details of construction work presented.

CONCRETE, FRANCE. Repair of Bomb-Damaged Structures in France, R. Levi and H. Lossier. *Engineer*, vol. 180, no. 4692, Dec. 14, 1945, pp. 484–485. Illustrated description of some novel methods developed by French civil engineers for repair of bridges, viaducts, etc., with special reference to stressing of concrete structures by use of expanding cement; two specific examples of concrete bridge and viaduct repair are given.

CONCRETE GIRDER. Rohrbruecken in Fertigbeton-Schalenbauweise, A. Scheunert. *Beton und Eisen*, vol. 88, nos. 31/32, Aug. 5, 1944, pp. 425–431. Pipe-line bridges of pre-cast concrete shell construction; illustrated description of bridges for support of overhead pipe lines between different buildings of large chemical plants; such shell girder bridges of reinforced concrete replace steel bridges formerly used, resulting in steel conservation and reduced costs.

MAINTENANCE AND REPAIR. Bridge Maintenance Practice on California Highway System,

O. M. Uhl. *Calif. Highways & Pub. Works*, vol. 24, nos. 3 and 4, March–April 1946, pp. 20–31. Illustrated report on methods of repair and maintenance of bridges as developed and field tested by Bridge Department of Division of Highways, California; report deals with repair of deteriorated surfaces, problem of weathering, recommendations for new bridges, use of air-entraining cement, etc. Bibliography.

MAINTENANCE AND REPAIR. Welded Sub-Truss Holds Bridge During Repairs. T. W. Reeves. *Construction Methods*, vol. 28, no. 5, May 1946, pp. 106–107. In order to repair damage to Fassett Street bridge, Toledo, Ohio, which was rammed by freighter, temporary truss was welded to old members, and damaged sections were removed and straightened or replaced; illustrations included.

MILITARY. Rhine—Major Bridge Job. W. C. Hall. *Military Engr.*, vol. 38, no. 244, Feb. 1946, pp. 68–69. Article tells how U.S. Army Engineers bridged Rhine River at Budenheim, near Mainz, Germany, with Bailey-type bridge supported on pile bents with center floating section, making over-all project about half a mile in length; constructional details.

NATURAL GAS PIPE LINES, RIVER CROSSINGS. Construction of 3,200-Ft. Natural Gas Pipe Line Suspension Bridge Over Red River, G. R. Lunt. *Petroleum Engr.*, vol. 17, no. 6, March 1946, pp. 198, 200, 202, and 204. Features of bridge carrying 24-in. pipe line of United Gas Company, at river crossing near Williams, La.

BUILDINGS

CONCRETE. "Conslab" System of Building Construction. *Engineering*, vol. 161, no. 4181, Mar. 1, 1946, p. 201. Illustrated description of method which is combination of assembly of prefabricated units with practice of pouring concrete in situ, designed primarily for providing housing without bricklayer or other skilled craftsman; desired building is outlined by erecting two structures of pre-cast slabs, vertically parallel with one another, and filling intervening space with concrete; slabs thus function both as shuttering and as part of wall.

HOUSES, PREFABRICATED. Tilt-Up Method for Placing Precast Wall Panels. *Construction Methods*, vol. 28, no. 3, Mar. 1946, pp. 108–109, 164, 166–167. Illustrated description of economical and short-cut method used in erecting pre-cast concrete wall panels for one-story commercial industrial, and residential buildings; panels are tilted into position by crane and braced until wall columns have been cast; steps in construction and equipment used.

HOUSING, EMERGENCY. Emergency Housing. *Arch. Forum*, vol. 84, no. 2, Feb. 1946, pp. 110–112. Illustrated notes on plans to use Nissen and Romlin huts in former military installations in England, as stop-gap shelters to relieve crucial housing shortage; architectural designs and layouts of dwellings and shops.

STRUCTURES, EARTHQUAKE EFFECT. Practical Earthquake Design. M. Falk. *Western Construction News*, vol. 21, no. 4, Apr. 1946, pp. 89–91. Formula is suggested for purpose of clarifying controversial problem concerning magnitude of forces caused by earthquake as basis of building design in West; table presents data on horizontally acting force on each floor of 30-story building.

CITY AND REGIONAL PLANNING

CHICAGO, ILL. To make Our Big Cities Friendly Group of Well-Planned Neighborhoods. *Am. City*, vol. 61, no. 2, Feb. 1946, pp. 79–80. Article discusses aspects of Chicago Plan Commission's Comprehensive City Plan for eventual attainment of 50 well-defined neighborhood communities, each combining advantages of large metropolis with those of small-city life; communities, averaging about 55,000 population, would be separated by system of expressways, waterways, open areas, or recreational buffer parks and other means.

TRAFFIC CONTROL. Urban Traffic-Congestion Problem. H. A. MacDonald. *Roads & Bridges*, vol. 84, no. 4, Apr. 1946, pp. 76–79, 122, 124, and 126. Anticipated 50% increase in motor traffic within 20 years necessitates construction of expressways or superhighways in metropolitan areas; problem is discussed with special reference to traffic conditions in Boston and other cities in Massachusetts. Before Can. Good Roads Assn., Quebec.

CONCRETE

AIR ENTRAINMENT. Application of Air-Entraining Agents in Concrete and Products. H. M. Kennedy and E. M. Brickett. *Pit & Quarry*, vol. 38, no. 9, Mar. 1946, pp. 144–146. Report on influence of certain air-entraining agents on density, strength, workability, and plasticity of concrete; results of tests are listed in table; necessity for proper control of use of air-entraining agents is stressed.

AIR ENTRAINMENT. Laboratory Studies of Concrete Containing Air-Entraining Admixtures. C. E. Wuerpel. *Am. Concrete Inst.—J.*, vol. 17, no. 4, Feb. 1946, pp. 305–357. Report on tests with nine different air-entraining admixtures in concrete under laboratory conditions; results of tests on plastic and hardened specimens with and without admixture presented in tables and charts; interpretation of significance of data and their application to use of air entrainment in concrete. Bibliography.

CONCRETE AGGREGATES, CORAL. Concrete at Advance Bases, I. S. Rasmusson. *Am. Concrete Inst.—J.*, vol. 17, no. 5, Apr. 1946, pp. 541–551. Illustrated report on use of coral aggregate for advance base concrete work of U.S. Navy in Pacific Islands; although this kind of concrete was generally inferior to that made with sand and gravel aggregates, results of temporary construction are reported satisfactory.

CONSTRUCTION, PUMP PLACING. Pumping Concrete to Spot. *Southern Power & Industry*, vol. 64, no. 2, Feb. 1946, p. 92. Brief description of methods employed in construction of Plant Atkinson, Georgia, which required pouring total of 11,300 cu yd of concrete by means of pump system similar to heavy duty piston-type water pump; job involved vertical lift of 135 ft in pumping concrete for roof of structure; capacity of Pumpcrete units used cited as 15–20 to 50–65 cu yd per hour.

CONSTRUCTION, REPAIR. Repair of Reinforced Concrete Damaged by Fire. *Concrete & Constr. Eng.*, vol. 41, no. 4, Apr. 1946, pp. 109–111. Recommendations of methods for repairing reinforced concrete columns and solid concrete and hollow tile floors damaged by fire, including effect of heat on color of concrete.

CULVERTS. Caging Creek with Traveling Forms. *Construction Methods*, vol. 28, no. 4, Apr. 1946, pp. 92–93, 156, and 158. Illustrated description of double-box culvert of reinforced concrete for boxing up Coldwater Creek at Lambert-St. Louis airport; unusually heavy culvert is designed to carry airport runways; traveling steel forms speed up construction; data on excavation, lining, and concrete.

CULVERTS. Double-Box Culvert 4,900 Feet Long. *Construction Advisor*, vol. 18, no. 4, Apr. 1946, pp. 71–72. Boxing in Coldwater Creek under extension of Lambert Airport, St. Louis, Mo., by means of double box of reinforced concrete is described and illustrated; data on steel forms for walls and roof are included.

DOCKS, FLOATING. Concrete Floating Docks. G. A. Maunsell. *Shipbldg. & Shipp. Rec.*, vol. 67, no. 11 Mar. 14, 1946, pp. 297–299. Shortly before D-Day it was anticipated that a large number of landing craft and other vessels would suffer damage during landing; it was necessary

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to make provision for repairing these craft on spot by means of floating docks; author describes manner in which docks were built in reinforced concrete at rate of one every four weeks; illustrations are included.

MASONRY STRUCTURES, REPAIR. Two Special Methods of Restoring and Strengthening Masonry Structures, J. W. Kelly and B. D. Keatts. *Am. Concrete Inst.—J.*, vol. 17, no. 4, Feb. 1946, pp. 289–304. Illustrated description of method of restoring damaged structures and foundations by means of pumping cement base stabilizing material called Prepakt, into small interstices, and filling larger spaces by aggregate which is then embedded in stabilizing material under pressure; applications to repair of bridges, reservoirs, dams, breakwaters, and spillway tunnel.

MILITARY ENGINEERING. Reinforced Concrete Marine Forts and Floating Docks, G. A. Maunsell. *Concrete & Constr. Eng.*, vol. 41, no. 4, Apr. 1946, pp. 97–106. Illustrated description of examples of reinforced concrete construction performed by British Admiralty, such as sunken forts, tower forts, floating docks; prefabricated units were extensively used; method is compared with assembling of lighters of large pre-cast units in United States.

DAMS

CONCRETE ARCH, WASHINGTON. Methods Used on Ross Dam by General-Shea-Morrison. *Pac. Bldr. & Engr.*, vol. 52, no. 4, Apr. 1946, pp. 44–52. Illustrated report on second phase of construction of Ross Dam on Skagit River in northwestern Washington, including rock excavation and scaling of canyon walls, aggregate handling, concrete placing, equipment used, etc.; Ross dam is third dam in Seattle's 1,120,000-hp hydroelectric project.

CONCRETE GRAVITY, QUEBEC. Coaticook Hydro-Electric Development Project, W. S. Lea. *Eng. & Contract. Rec.*, vol. 59, no. 3, Mar. 1946, pp. 60–61, 156–157. Illustrated description of hydroelectric development for Coaticook, Quebec, particularly of stop-log dam built in 1944; discussion of dam specifications for concrete-gravity dam and comparison with dam built in 1926.

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CONCRETE, REPAIR. Maintenance of Heavy Concrete Structures Minnesota Power & Light Company Practice, C. C. Boswell and A. C. Giesecke. *Am. Concrete Inst.—J.*, vol. 17, no. 4, Feb. 1946, pp. 277–285. Illustrated description of repair of concrete Fond-du-Lac Dam on St. Louis River, Minn.; discussion of maintenance problem, repair program, and repair work, detail of heavy concrete repair slab, and comparison with much older Thomson Dam, also on St. Louis River, which has needed no repair, because of better construction methods.

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ROADS AND STREETS. Improved Road Construction by Soil-Processing Technique, R. [illegible] Gray. *Roads & Bridges*, vol. 84, no. 4, Apr. 1946, pp. 82–83, 165–168, 170–172. Illustrated discussion of improved methods of foundation design for roads considering subgrade, soil utilization, economy, standards, soil stabilization, and asphalt binders. Before Can. Good Roads Assn.

HYDRAULIC ENGINEERING

RIVERS. Effect of Obstructions in Tidal Estuaries, A. M. Binnie. *Engineering*, vol. 161, no. 4183, Mar. 15, 1946, pp. 241–242. Analysis of tidal oscillations gives confirmation of A. H. Gibson's results; although bridge piers are usually too small to have noticeable effect upon tides at top of estuary, agreement between experiment and theory is demonstrated, because Gibson's results were so unexpected that doubt was cast on validity of using models to predict behavior of estuaries; appendix gives extension of Lamb and Cook's theory.

SURGE TANKS. Pneumatic Surge Tank Solves Water Hammer Problem, M. A. Libby. *Water & Sewage Works*, vol. 93, no. 3, Mar. 1946, pp. 96–99. Illustrated description of installation and operation of pneumatic surge tank at Bath, Maine; charts present pressure record before and after placing surge tank in service revealing solution of water-hammer problem by means of this installation.

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Aqueduct

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RESERVOIRS, SWITZERLAND. Une amélioration du pouvoir d'accumulation des lacs de Joux et Brenet, J. Calame and C. Paschoud. *Bul. technique de la Suisse, Romande*, vol. 72, no. 1, Jan. 1, 1946, pp. 1–6. Illustrated description of improvement of storage capacity of lakes Joux and Brenet, Switzerland, including difficulties encountered, construction work such as tunnels and sluices.

TENNESSEE VALLEY AUTHORITY, KENTUCKY DAM. Kentucky Dam on Tennessee River, H. Wiersema. *Engineering*, vol. 161, nos. 4187, 4189, and 4191, Apr. 12, 1946, pp. 337–339; Apr. 26, pp. 385–388; and May 10, pp. 433–436. Illustrated description, by assistant to chief engineer, Tennessee Valley Authority; planning of project; foundation exploration; three main features of dam are navigation lock, power house, and spillway, which are described.

FLOOD CONTROL

AUSTRALIA. Flood Control and Bridge Construction, M. G. Dempster. *Commonwealth Engr.*, vol. 33, no. 10, May 1, 1946, pp. 341–342. Discussion of methods for calculation of flood discharges, and factors, particularly economic, involved in design of bridges in relation to probable floods.

FOUNDATIONS

BRIDGE PIERS. Texas Bridge Footing Shells Drilled and Under-Reamed, J. P. Eyan. *Roads & Streets*, vol. 89, no. 3, Mar. 1946, pp. 90–91. Illustrated description of foundation of South Concho River Bridge in San Angelo, Tex.; hole was drilled down to limestone and footing, then reamed to proper size; 30-in. steel casing was placed in hole and driven into underlaying soft shale, sealing off ground water; prefabricated steel column was set and concrete placed.

BRIDGE PIERS, RECONSTRUCTION. Stabilizing South Pier of Cockshutt Bridge, Brantford, R. F. Legget. *Eng. & Contract Rec.*, vol. 59, no. 4, Apr. 1946, pp. 52–55, and 170. Illustrated description of progressive horizontal movements of top of south pier of Cockshutt Bridge, Brantford, Ont., and discussion of their causes; data on new bridge using beam and cantilever type of reinforced concrete structures—three 113-ft spans, two 99-ft spans, and two short cantilever spans 61 ft long; data on erosion and landslide of adjacent river bank included.

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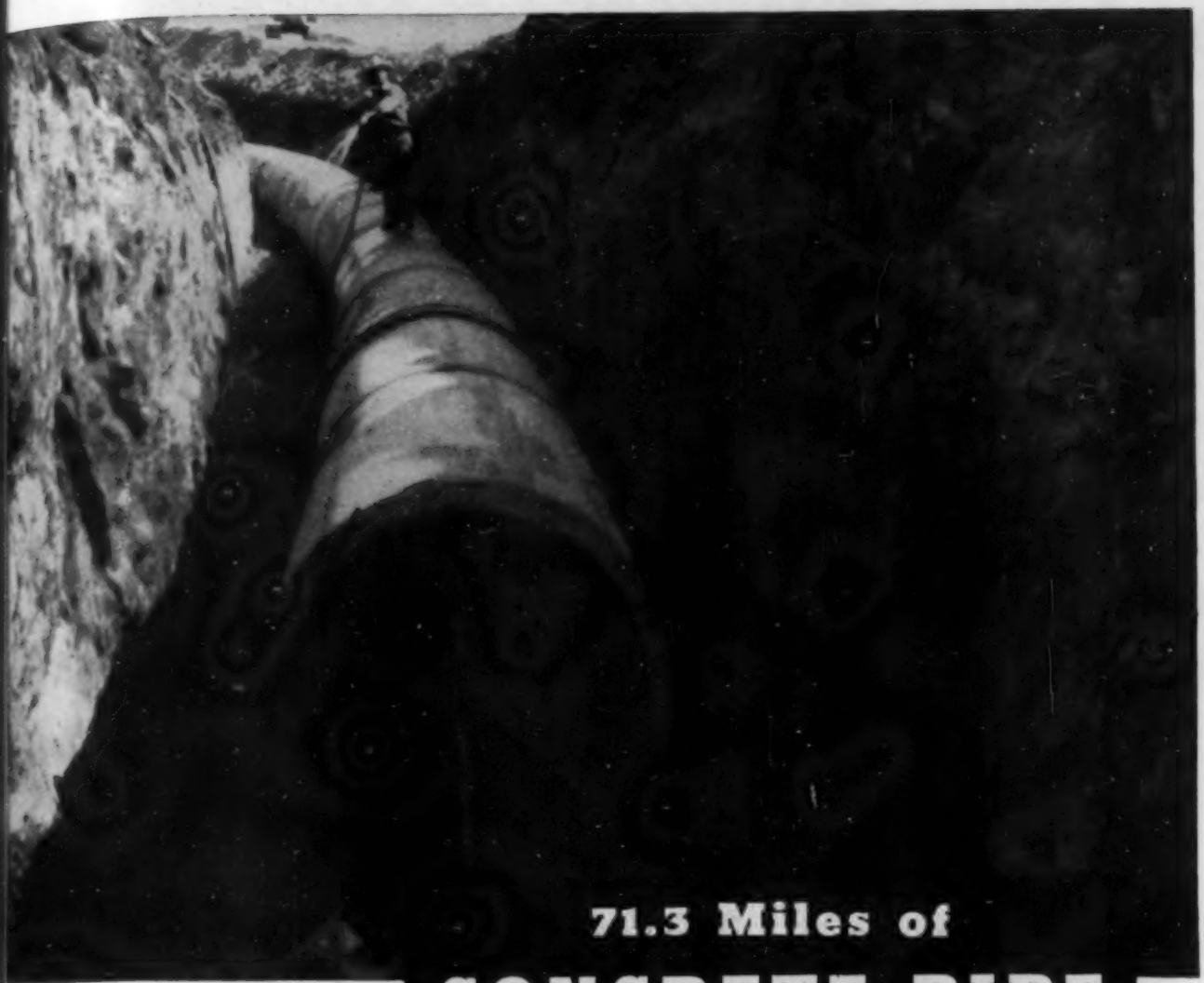

71.3 Miles of
CONCRETE PIPE
in San Diego Aqueduct

54-in. spiral reinforced concrete high pressure pipe being installed for San Diego Aqueduct in a section near Winchester, Calif.

RAPID construction without use of critically scarce materials was a primary requirement for the 71.3 mile gravity flow aqueduct now being built to avert a water shortage in San Diego, Calif.

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pacity three times that of Boulder, Grand Coulee and Shasta dams combined; engineer's sketches included.

IRRIGATION

COLUMBIA BASIN. Columbia Basin Irrigation, G. Kirkpatrick. *Excavating Engr.*, vol. 40, no. 5, May 1946, pp. 238–241, 274, and 276. Illustrated description of Columbia Basin irrigation project in south-central Washington, including general layout, earth-fill dams, canals, and pumping units; list of estimated dimensions and quantities of materials and data on construction work for $300,000,000 project are included.

INDIA. Dindi Project, K. Azeemuddin. *Instn. Engrs. India—J.*, vol. 25, no. 4, June 1945, pp. 14–29, 2 supp. plates; vol. 26, nos. 1 and 2, Sept., pp. 43–60; Dec., pp. 44–67, supp. plate. Description of design and construction of Dindi irrigation project at Deccan Plateau, India; paper deals with historical and geological aspects, scope of project, hydrology, maximum flood discharge, flood-absorbing capacity of Dindi Reservoir and gives data on rainfall; earth dam and masonry dam are described in detail.

OREGON. How Inlet Transition Steps Up Flow in Irrigation Flume, J. I. Hess. *Pac. Bldr. & Engr.*, vol. 52, no. 5, May 1946, pp. 54–55. Illustrated description of new design developed on Central Irrigation District project in Oregon, consisting of prefabricated, pressure-creosote-treated cradles and flooring; excellent results are reported since water enters flume with scarcely a ripple while former design caused violent turbulence.

LAND RECLAMATION AND DRAINAGE

AIRPORTS. Idlewild Airport Drainage, J. K. Glidden. *Roads & Streets*, vol. 89, no. 4, Apr. 1946, pp. 67–72. Illustrated description of well-point system featuring drainage in hydraulic-fill area of site for Idlewild Airport, New York City; includes Horner test wells, storm sewer, subdrains, sand trap, single-barrel sewer, reinforced-concrete pipes for larger sizes, asbestos cement pipes for smaller sizes, pipe cradles, construction methods and runways.

CULVERTS. Triple Culvert Through New Levee, W. H. Quirk. *Highway Mag.*, vol. 37, Mar. 1946, pp. 52–55. Illustrated description of 72-in. gravity drainage structure near Fort Chartres, Ill., consisting of three 8-gage asphalt-coated galvanized corrugated iron pipes; diaphragms, also of corrugated metal, were installed every 20 ft to prevent formation of seepage along pipe; data on construction work, headwall foundations, and sluice gates, and description of smaller drainage structure included.

HAWAII. Drainage No Problem, J. D. Campbell. *Military Engr.*, vol. 38, no. 244, Feb. 1946, pp. 56–59. Article describes handling of drainage problem by U.S. Naval Construction Battalions in building naval air station in vicinity of Hilo, Hawaii; geological aspects of formation of islands; porosity of volcanic clinker as aid to drainage; method of waste-water and sewage disposal by digging drain holes and sumps through impervious lava layers overlying deeper porous lava; construction of roads, swimming pools, and other camp facilities.

MATERIALS TESTING

CEMENT, AIR-ENTRAINMENT. Effect of Air-Entrainment on Durability of Concrete Pavement in Ohio, J. F. Barbee. *Crushed Stone J.*, vol. 21, no. 1, Mar. 1946, pp. 28–37. Report on tests and practical experiences with air-entrained cement and concrete; comparison with normal portland cement concrete as to scale and resistance to freezing and thawing; percentage of entrained air should be not less than 3%.

CONCRETE AGGREGATES. Expansion Test as Measure of Alkali-Aggregate Reaction, R. F. Blanks and H. S. Meissner. *Am. Concrete Inst.—J.*, vol. 17, no. 5, Apr. 1946, pp. 517–539. Study of cement with inordinate alkali content by means of measurements on specimens subjected to curing in closed moisture-laden containers; study includes development of cracking, temperature, admixtures, amount, and size of reactive aggregate cement content, cement fineness, moisture, and storage conditions, etc.; results shown in charts, tables, and illustrations.

PORTS AND MARITIME STRUCTURES

BALTIMORE, MD. Port of Baltimore. *Natl. Gas.*, vol. 138, no. 5, May 1946, pp. 50–55. Port facilities shown on map and briefly discussed; railroads are main arteries of supply; Baltimore and Ohio first railroad; Canton railroad terminal; Western Maryland Railroad; Pennsylvania Railroad; harbor craft and longshore labor; Bethlehem-Sparrow Point shipyard; Maryland Drydock Co.; other shipyard facilities.

CAISSONS. "Shark" Sectional Dock Caissons. *Engineer*, vol. 180, no. 4693, Dec. 21, 1945, pp. 503–504. Illustrated description of caisson which could be used in numbers to replace damaged dock gates in ports subject to large tidal range; scheme was to produce standard steel tanks capable of being floated and towed into position; caisson, when flooded, rests on prepared bed on lock bottom, but has sufficient clearance at sides, by reason of flaps, to enable it to be floated out of entrance at high water to allow shipping to enter dock.

THROUGH FOUR SEVERE WINTERS... "NO DETERIORATION OR CRACKS"*

* U. S. Army District Engineer Inspection Made Oct. 1945

Built by Portland District, U. S. Army Engineers.

COLUMBIA RIVER JETTY TERMINAL *built with* POZZOLITH CONCRETE

Excerpt from article, Pacific Builder and Engineer, April 1944 —

"The grading of aggregates and the mix were in accordance with standard government specifications, and provided for at least 4½ sacks of cement (Fed. Spec. SS-C-206) per cu. yd. The contractor was allowed to use an admixture of Pozzolith, at his own expense, to provide greater workability, as the long journey over the rough railroad track otherwise made it difficult to dump the concrete on arrival at the work."

Exposed to salt water corrosion and wave action, in addition to freezing and thawing, through four severe winters, this Pozzolith Concrete jetty terminal at the mouth of the Columbia River shows no deterioration or cracks.

Here is an excellent example of the great durability of Pozzolith Concrete even under extremely severe conditions.

Pozzolith produces all the benefits of air entrainment and does so with increased strength and at lower cost. Findings of the Nation's top testing authority prove this. Pozzolith's high standard of performance has won it wide acceptance as use in millions of cubic yards of concrete testify.

Write for complete information on the advantages of cement dispersion, and Pozzolith folder . . . today.

THE MASTER BUILDERS COMPANY

CLEVELAND 3, OHIO · TORONTO, ONTARIO

MASTER BUILDERS

ROADS AND STREETS

AIRPORT RUNWAYS. Airfield Load Tests in Progress at Selfridge Field. *Roads & Streets*, vol. 89, no. 5, May 1946, pp. 94–95. Illustrated description of frost investigation at Selfridge Field, Michigan; purpose is to measure deflection in concrete under various soil conditions as result of certain applied pressures, and to determine effect of frost on load-carrying capacity of pavement.

AIRPORTS, MAINTENANCE AND REPAIR. Airfield Maintenance in New Mexico. H. K. James. *Western Construction News*, vol. 21, no. 4, Apr. 1946, pp. 87–89. Illustrated report on maintenance of Kirtland Field, N. Mex., including filling depressions, dust prevention, livening old surfaces, etc.

AIRPORTS, NEW YORK CITY. New York Builds $200,000,000 Airport. L. Beauchamp. *Int. Engr.*, vol. 89, no. 4, Apr. 1946, pp. 7–9. Report on Idlewild airport in New York City now progressing on second stage; data on runway design, dredging for fill, grading, paving, aprons, taxiways, and accessibility.

BITUMINOUS. Carpeting Is Often Adopted Without Justification. E. A. Rundell. *Surveyor*, vol. 105, no. 2829, Apr. 12, 1946, pp. 279–280. Discussion of bituminous macadam of ½ to ¾ in. thickness, and of surface dressing—namely, thin film of tar or bitumen and embedding stone or slag chippings; long-term costs are considered from point of view of initial costs, life, maintenance cost, and type of treatment; resistance to skidding, night visibility, and degree of comfort afforded also considered.

EMBANKMENTS. Iowa's New Embankment Specification. *Roads & Streets*, vol. 89, no. 5, May 1946, pp. 67–69. Discussion of Iowa's new embankment specification, including description and preparation of site, use of roller for compaction, and construction of embankment; principal change from old specification is requirement of sheepsfoot in place of smooth roller.

EMBANKMENTS. New Developments in Use of Asphalt in Erosion Control. *Roads & Streets*, vol. 89, no. 4, Apr. 1946, pp. 90–92. Illustrated description of use of asphalt in control of embankment erosion either as asphaltic concrete mat for protection against wave where road follows lakeshore or as thin film of asphalt for general protection against wind or rain water erosion.

HIGHWAY ADMINISTRATION. Attaining New Objectives in Road Development. T. H. MacDonald. *Better Roads*, vol. 16, no. 4, Apr. 1946, pp. 19–20, 32, and 34. Steps taken or planned in preparation to meet broadened responsibilities of highway agencies include re-organization of Public Roads Administration and establishment of new means of cooperation with state, county, and municipal officials; improved highway personnel practices suggested.

SEWERAGE AND SEWAGE DISPOSAL

BIOCHEMICAL OXYGEN DEMAND. Controlling Biological Processes by B.O.D. Tests. D. E. Bloodgood. *Sewage Works Eng. & Mun. Sanitation*, vol. 17, no. 4, Apr. 1946, pp. 207–208, and 213. Data on sewage treatment plants at Marion, Ind., and Stickney, Ill.; application of B.O.D. tests to activated sludge plant operation; computation of proper loading; B.O.D. as measure of plant efficiency; it is useful tool for controlling load on biological sewage treatment; illustrations.

SEWAGE FILTERS, TRICKLING. High Capacity Trickling Filters. J. A. Montgomery. *Water & Sewage Works*, vol. 93, nos. 1 and 3, Jan. 1946, pp. 35–41, and Mar., pp. 119–124. Study and interpretation of single and two-stage high capacity trickling-filter operation; application, recirculation, B.O.D. removals, and filter efficiencies discussed; causes of inferior results in trickling filters analyzed; efficiency of various filters compared; general methods used for recirculation explained. Bibliography.

SEWERS, CLEANING. Cleaning Newark's Catchbasins. *Am. City*, vol. 61, no. 2, Feb. 1946, pp. 76–77. Brief pictorial description of use of Eductor pump unit and small crane with orange-peel bucket, for continuous cleaning of catchbasins in Newark, N.J.; operating characteristics of equipment.

SLUDGE DIGESTION. Disposal of Sewage Sludge. R. Hicks. *Surveyor*, vol. 222, no. 2830, Apr. 19, 1946, pp. 303–306. Discussion of methods of handling sewage sludge, such as disposal at sea, direct disposal of liquid sludge to land, use of open or covered drying beds, dumping in large lagoons, dewatering in hydraulic presses, with or without lime, etc.; report on sludge disposal at Sewage Purification Works at Hamilton, Scotland, including cost data. Before Inst. of Sewage Purification, Scotland.

TREATMENT PLANTS, EAST CHICAGO, IND. Sewage Plant Safeguards Health and Industry. *Am. City*, vol. 61, no. 2, Feb. 1946, pp. 97 and 98. Description of East Chicago's new biochemical sewage treatment plant for protection of city water supply and lake-shore facilities, designed for 20-mgd hydraulic capacity and serving population of about 55,000; data on Guggenheim treatment process and plant equipment.

TREATMENT PLANTS, GERMANY. German Water Sewage Plants Examined by U.S. Technicians.

THE *San Diego Aqueduct*

...ANOTHER PERMANENT WATER ARTERY FOR THE WEST!

" LOCK-JOINT CONCRETE PIPE being manufactured at South Gate Plant of AMERICAN PIPE AND CONSTRUCTION CO. . . . for that section of the aqueduct from the ast Portal of the San Jacinto Tunnel to the Regulatory eservoir, approximately 2 miles to the south.

WO BULLETINS . . .
OR YOUR INFORMATION

Interesting data and factual information have been assembled into these two bulletins. They describe the use of Reinforced Concrete Cylinder Pipe in present main water supply lines in the Los Angeles and San Diego areas. Write for them!

MERICAN PIPE & CONSTRUCTION CO.
Manufactures and installs:

Lock-Joint Concrete Cylinder Pipe
PRESTRESSED Lock-Joint Concrete Cylinder Pipe
AMERICAN Concrete Cylinder Pipe
Hume Centrifugal Concrete Pressure Pipe

S COMPANY also manufactures concrete pipe for storm sewers, sanitary sewers, culverts, highway and airport drainage, and many other uses.

MAIN OFFICE AND PLANT ADDRESS
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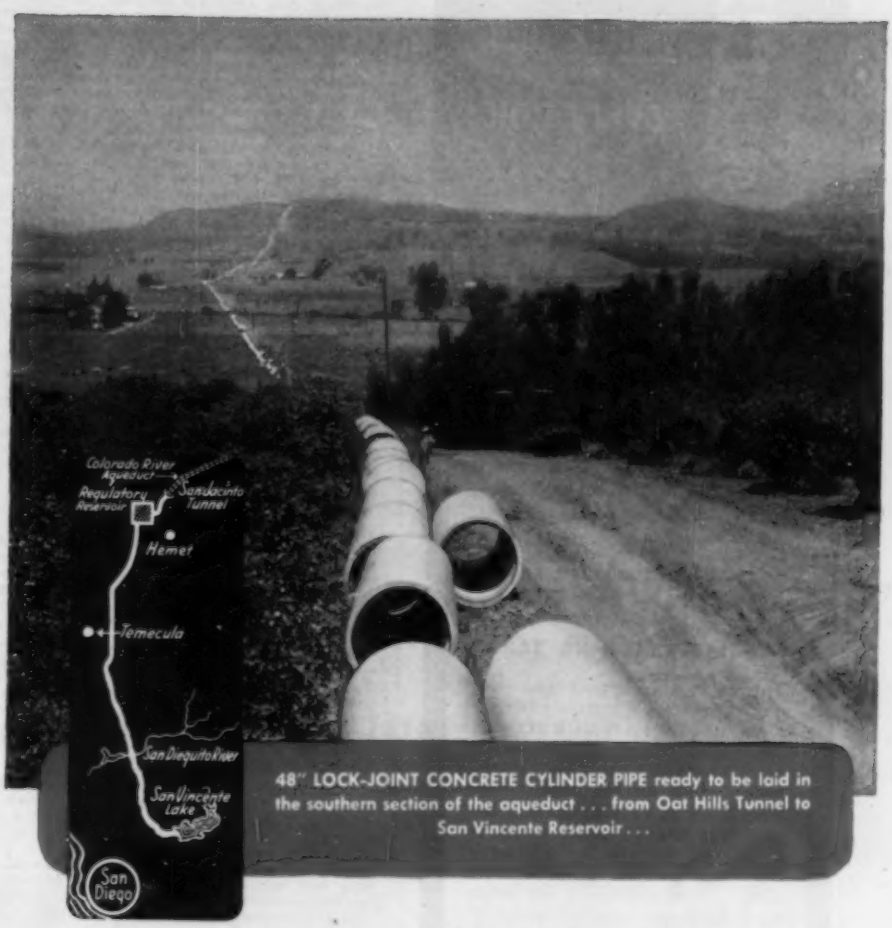
Mailing Address
P. O. Box 3428, Terminal Annex, Los Angeles 54
OFFICES AND PLANTS
Oakland, San Diego, South Gate, California
Portland, Oregon



48" LOCK-JOINT CONCRETE CYLINDER PIPE ready to be laid in the southern section of the aqueduct . . . from Oat Hills Tunnel to San Vincente Reservoir . . .

Approximately 65 miles (total length 71.3 miles) of the San Diego Aqueduct will be constructed of *Lock-Joint Concrete Pipe,* a *permanent,* economical type of construction with high initial and *sustained* carrying capacity!

The San Diego Aqueduct will carry water from the Colorado River Aqueduct of the Metropolitan Water District of Southern California to the San Vincente Reservoir some 20 miles northeast of San Diego. It will provide, when finished, another permanent water artery for the rapidly developing West!

American
PIPE & CONSTRUCTION CO.
LONG-LASTING WATER SUPPLY LINES

Am. City, vol. 61, no. 2, Feb. 1946, pp. 133 and 135. Extracts from papers by A. C. Gorman and A. J. Fischer on water treatment and sewage practices in Germany; data on installations at Munich, Nuremberg, and other cities for water purification; use of sewage treatment plants for production of digester gas for autos.

TRAFFIC CONTROL

INTERSECTIONS. Progress in Grade Separations, H. W. Giffin. *Roads & Bridges*, vol. 84, no. 4, Apr. 1946, pp. 84–86, 142 and 144. Illustrated study of grade separations on divided highways at points where traffic signals would otherwise be required; problem is discussed in connection with traffic circle and intersections in New Jersey. Before Good Roads Assn., Quebec.

TUNNELS

VEHICULAR, CALIFORNIA. Truck Subway Serves Stores. *Western Construction News*, vol. 21, no. 4, Apr. 1946, pp. 98–100. Substreet artery, 2,000 ft long and wide enough for two large trucks, has been built in Los Angeles, Calif., and leads to Broadway-Crenshaw shopping center; thus merchandise can be delivered into basements, eliminating unsightly loading and much handling; illustrated description of project, including measures against ground water; tunnel construction, ventilation, lighting, etc.

VENTILATION. Hoosac Tunnel Gets New Propeller Fans. *Ry. Age*, vol. 120, no. 8, Feb. 23, 1946, pp. 399–401. Boston & Maine has completed installation of two large electrically operated, propeller-type fans, in new fan house, for ventilating double-track Hoosac tunnel through Berkshire Hills in western Massachusetts; fans, replacing old, inefficient ventilating fan, were installed to secure larger blower capacity, and improve air, moisture, and general operating conditions in tunnel; fans are 90-in., Jeffery Type-8H Aerodyne mine fans, each with capacity of 260,000 cu ft per min.

VENTILATION. Lueftung von Alpen-Strassentunneln, W. Wirz. *VDI-Zeit*, vol. 88, nos. 47/48, Nov. 25, 1944, pp. 650–652. Ventilation of Alpine vehicular tunnels; effect of exhaust gases on tunnel users; proper utilization of natural (meteorological) conditions; comparison of different tunnel ventilation systems, with special reference to conditions in Alpine tunnels.

WATER PIPE LINES

AQUEDUCT, COLORADO RIVER. San Diego Aqueduct—Water Assured from Colorado River. *Western Construction News*, vol. 21, nos. 4, Apr. 1946, pp. 81–86. Illustrated description of construction of 71.3-mile aqueduct for water supply of San Diego, Calif., from Colorado River; tunnels, regulating reservoir, siphons, and reinforced concrete and steel pipe are included in description.

LOSSES. "Friction Loss" in Pipes, R. W. Powell. *Ohio State Univ.—Eng. Experiment Station News*, vol. 18, no. 2, Apr. 1946, pp. 14–17. Discussion of formulas used for computation of pressure drop in pipes due to roughness; charts may be used for design when size of pipe and flow are given and loss of head is desired; constants of Karman formulas are listed in table.

TEMPORARY. Five Mile Surface Pipe Line Supplies St. Catharines While New Feeders Are Built, A. L. McPhail. *Eng. & Contract. Rec.*, vol. 59, no. 3, Mar. 1946, pp. 100, 102, 104, and 108. While new feeder main was installed at St. Catharines, Ontario, Canada, temporary line of cast iron was laid, following contour of ground; illustrated description of temporary and permanent line of filtration plant, pump station, etc.

WATER RESOURCES

MASSACHUSETTS. Water Supply Developments in Boston, Massachusetts, K. R. Kennison. *Water & Water Eng.*, vol. 48, no. 597, (Winter) 1945, pp. 681–698, (discussion) 698–703. vol. 49, no. 601, Apr. 1946, (author's reply) pp. 155–158. Illustrated report on water supply of Boston, Mass., its history, development, organization, and recent additions of new sources of supply from Ware and Swift rivers; technical details of various aqueducts, dams, reservoirs, dikes, and reinforced concrete pressure pipe line presented, including cost and capacity. Before Instn. Civ. Engrs.

MILITARY ENGINEERING. Water Supply for Stilwell Road, C. W. Christenson. *Public Works*, vol. 77, no. 4, Apr. 1946, pp. 19–22 and 49. Problem of drinking water supply, for troops scattered along Stilwell Road over distance of 467 miles; illustrated description of deep wells, shallow wells, semi-portable and portable purification units, superchlorination and dechlorination, data on bacteriological tests, etc.; boiling as means of water purification; author suggests what should have been done.

ONTARIO. Reservoir and Pumping Station with Special Features, A. Brisset Des Nos. *Water & Sewage*, vol. 84, no. 3, Mar. 1946, pp. 27–30, 58–60. Illustrated report on water supply facilities in Montreal, Canada, brought into operation during war; descriptions of old and new reservoir and of old and new pumping station are included; new Cote-des-Neiges reservoir with capacity of 7,500,000 imperial gal is of concrete; there are facilities for increasing capacity to 15,000,000 gal; data on distribution system and auxiliary works presented.

Equipment, Materials and Methods

New Developments of Interest, as Reported by Manufacturers

First Vaporsphere Installed

THE FIRST VAPORSPHERE for reducing evaporation losses from flat-bottom tanks storing volatile liquids has been installed at the Hempstead Oil and Storage Company at Mobile, Alabama. This spherical structure, which prevents loss by providing temporary storage for vapor displaced by breathing, was designed by the Chicago Bridge & Iron Co., Chicago, Ill.

The Vaporsphere at the Hempstead Oil and Storage Company has a capacity of 5,000 cu. ft. and is connected to the vapor spaces of two flat-bottom tanks storing motor gasoline by 6-in. diameter lightweight vapor lines forming an effective vapor saving system. When increasing temperatures cause expansion in the tanks the excess vapor flows through the vapor lines into the Vaporsphere where it is stored temporarily. When conditions causing its displacement have changed, the vapor returns to the tanks.

Vaporspheres are also used to prevent filling losses from pressure tanks by designing them to operate at the same pressure as the tanks and equipping the air space with a pressure regulator.

The Vaporsphere consists primarily of a spherical steel shell with a flexible hemispherical membrane on the inside. It is connected to the shell at the equator. Vapor is stored beneath the membrane and the space above is filled with air at all times. The Vaporsphere is supported by four structural cradles resting on individual concrete piers.

Rock Tunneling Handbook

A 272-PAGE BOOK entitled, "Rock Tunneling with Steel Supports," is in essence a handbook on this type of tunneling.

It is the purpose of the book to review those tunnel problems which involve support systems and to suggest means of solving these problems so that rock tunneling can be done faster, cheaper, and safer.

Four sections of the book cover the subject:

First—A section devoted to engineering geology contains the geological information which is required for estimating the rock pressure on tunnel supports. This section has been prepared by Karl Terzaghi, Member ASCE, Inst. C.E. (London).

Second—A section is devoted to the relationship between rock behavior, type of steel support, and the method of excavation.

Third—Analytical methods of design of the supporting structure under assumed loading conditions are discussed.

Fourth—A catalog is included containing a description of the steel supports which are manufactured by The Commercial Shearing & Stamping Co. The design of these supports is based on experience gained in supplying steel support to several hundred tunnels for over a quarter of a century.

The book is complete with photographs and well-known tunnels, diagrams, and detailed information on tunneling. 7½ by 10¾ in., 272 pages, $2.50 postpaid.

It is intended to be helpful to the designing engineer, in the drafting room, the resident engineer on the job, and the contractor, his project engineer and his superintendent. Commercial Shearing & Stamping Co., Youngstown, Ohio.

Loading Device for Trucks

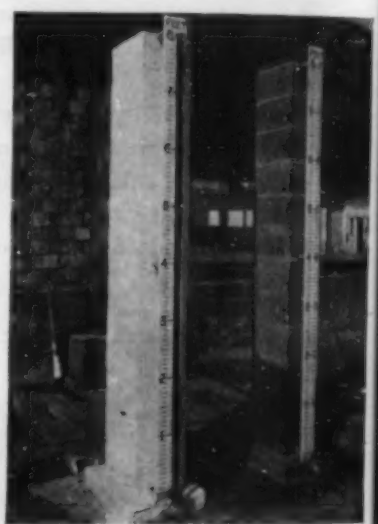
A NEW DEVELOPMENT in truck loading devices is the Cascade Scrape-Loader announced by the Cascade Manufacturing Co., 2439 N.W. 29th Ave., Portland 10, Ore.

The Scrape-Loader is a maintenance tool requiring no power plant or power take-off from the truck motor. One

man operates the ¹/₉-cu. yd. scraper in the ditch, the driver remains in the truck. The Scrape-Loader is adaptable to any standard dump truck and is in conformity with legal height and width limits of the several states. Here is how it works: The boom, pivoted at its base, swings out over the ditch. The scraper is pulled along the ditch, while truck travels forward, by means of a cable attached to a drawbar which projects out from the truck below the boom. This drawbar is hinged to drop down out of the way when not in use. The hoisting device is a winding drum attached to rear wheel of truck which, by simply backing the truck, supplies the power for raising scraper from the ditch and swinging it up over truck body. By means of a trip-line, the scraper operator guides the bucket to desired unloading position and then trips the load. The truck then travels forward and scraper is returned to the ditch, landing in the exact spot from which it was lifted. Complete details and specifications are available.

Waterproofing Tests

AQUELLA PRODUCTS, Inc., Richmond Hill, N.Y., reports a series of waterproofing tests conducted at the Long Island City plant of the National Brick Corp. for the purpose of demonstrating the effect of a hydrostatic pressure created by 8 ft head of water on a surface which had been treated with Aquella.



Two test towers, made of highly porous cinder concrete blocks, were constructed, with the absorption rate of the blocks predetermined as being from 22% to 25% by weight. First, both columns were tested in their natural state and showed that they had identical coefficients for permeability. After this test, the column on the left was treated with Aquella, while the one on the right was not. The Aquellized tower is reported to have withstood the pressure of an 8-ft head of water, equivalent to a hydrostatic pressure of approximately 500 lb per sq ft, at the base. The un-Aquellized tower could not be filled with water higher than 18¼ in., because the water seeped through its cinder concrete block walls at the rate of 2 gal per minute.

Vise Forms Wire Rope Loops

THE NUNN MANUFACTURING CO., Evanston, Ill., announces a vise which forms a loop in wire rope by turning one hex nut with an ordinary wrench. The vise automatically compensates for rope sizes within its designed range and holds the loop firmly through the splicing or clamping operations.

Cabl-Vise is equipped with a swivel base that accommodates the vise in either vertical or horizontal position and rotates through 360 degrees, clamping firmly in any direction. Cabl-Vise No. 1 takes rope sizes $^1/_4$ in. through $^1/_2$ in. Cabl-Vise No. 2, equipped with hydraulic booster and accommodating rope $^5/_8$ in. through $1^1/_2$ in. heavy duty will be announced shortly.

Tandem Rollers

A NEW LINE OF streamlined tandem rollers incorporating many mechanical improvements has been announced by the Buffalo-Springfield Roller Company of Springfield, Ohio. These models supplement the 10 and 12-ton 3-wheel rollers and 3–4 ton tandem previously announced by this company. The new models are produced in sizes of 5–8 tons, 6–9 tons, 8–12 tons, and 10–14 tons and can be powered with either gasoline or Diesel engines.

Many of the principles of previous Buffalo-Springfield tandems are included in the new design including the bevel gear final drive, side air intake, drive-opposite-operator, simplified clutch shifter, low pressure hydraulic steering, and compact engine, transmission, and final drive pinion unit assembly. A new 4-speed forward and reverse transmission has been added to provide a properly stepped speed range.

Increased operator vision is provided with the new models, and the sprinkler tank capacity has been considerably increased. A removable drive roll grill adds to the appearance of the roller besides providing a readily accessible opening for cleaning and ventilating the drive roll.

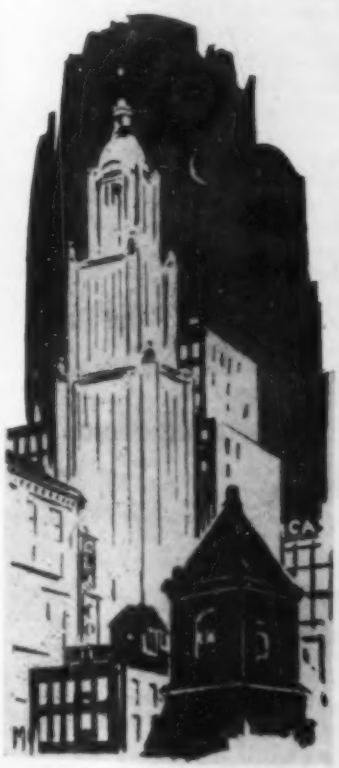
Rear-Mounted Cable Control

MANUFACTURE OF A new rear double drum cable control is announced by Caterpillar Tractor Co., Peoria, Ill. The unit, designated as the No. 25, embodies features designed for the heaviest service imposed on "Caterpillar" Diesel D8, D7, and D6 Tractors in the operation of the largest scrapers, and of bulldozers and rippers.

The multiple disk clutch with metallic facings is the same type used for many years in the Company's track-type tractor line, and synchronized brake release and clutch engagement also add to the smooth operation of the unit. To permit rapid free spooling, the control responds quickly, with a minimum of effort that eliminates operator fatigue. Other outstanding features of the rear cable control include large-diameter, specially grooved sheaves; large brake capacity; longer life through use of anti-friction bearings and recessing of cable drums in the case; compact design which permits mounting close to the tractor for protection against damage, and for improved balance; and a rugged cast steel case assuring freedom from distortion.

Complete information and literature on this new cable control will be forwarded by the manufacturer.

WHEN Millions Live As One



ADVENTURESOME folk, since the beginning of time, have migrated . . . Settling in tiny clusters . . . Spreading spider-web fashion to dot the land with villages and towns . . . While others pressed forward, facing dangers concealed behind each rock and tree!

But with the growth of cities, new perils arose and multiplied . . . People were living too closely together . . . Epidemics and pestilence exacted their toll . . .

Then science and modern machinery rescued them from exposure to disease emanating from impure water and unsanitary waste disposal . . . And, today, *millions live as one!*

Rotavalves and Axial Flow Pumps, by Smith, are in service—controlling water, controlling floods, and regulating sewage discharge, in important systems, far and wide.

The recognition and acceptance given these products are not accidental. They come from superior design, resulting from our more than 72 years of hydraulic experience . . . Facts that are significant, because they are proof positive of our ability to serve you, *if you place your problem in our hands!*

S·MORGAN SMITH COMPANY

YORK·PENNSYLVANIA~U·S·A·

If It's Hydraulics-Put It Up to Us·

POWER by SMITH

New Surveying Altimeter

NEW STANDARDS of accuracy and sensitivity have been reached by the American Paulin System, Los Angeles, Cal., in their new "SA" series of Surveying Altimeters. Made in several models to cover all ranges of elevation above and below sea level, laboratory tests have shown these instruments to respond to elevation changes in inches, or a sensitivity of better than one part in twelve thousand. Throughout the entire range, accuracy is better than one part in one thousand.

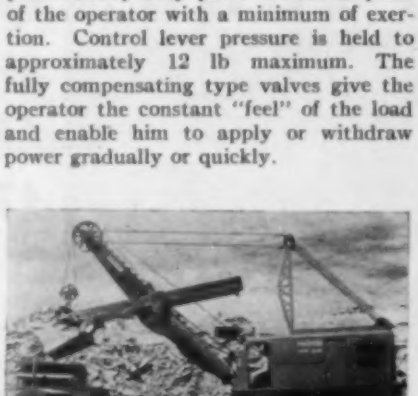
These instruments have proved themselves ideal for all preliminary survey work, and will stand up under rugged field service. Each instrument comes encased in a leather carrying case with hand and shoulder straps and will withstand the jolts, jars, and vibrations in all conceivable field uses without affecting the sensitivity or accuracy. The American Paulin instrument operates on the nul or zero-gaging system and is so completely compensated for instrument temperature error that no correction is necessary. Instrument indicates altitude immediately without lag and it is never necessary to "tap" the glass or vibrate the instrument in taking readings. Indicators are knife-edge and needle-point design with mirror to eliminate parallax and give accurate readings. Diameter of dial, 4¾ in. Weight, with leather carrying case, two pounds.

Prior to the war, Paulin System instruments were made in Sweden. Now, however, the entire line is made in the United States by the American Paulin System, pioneer concern in this country in the development of sensitive altimetry.

4-Yard Heavy-Duty Shovel

MARION POWER Shovel Co., Marion, Ohio, announces a new 3½-4 cu yd machine—Type 111-M—for heavy-duty service in mining, quarrying, stripping, and general construction. The 11-M is a Diesel-powered machine which can be readily shipped without major dismantling and which is also quickly convertible to dragline or clamshell service. It is of all-welded construction with a low center of gravity, making the machine stable under all digging conditions. Variable crawler widths and lengths are offered for individual job requirements.

The Type 111-M Diesel power plant, in combination with Marion air control with fully compensating type valves, places heavy-duty power at the disposal of the operator with a minimum of exertion. Control lever pressure is held to approximately 12 lb maximum. The fully compensating type valves give the operator the constant "feel" of the load and enable him to apply or withdraw power gradually or quickly.



The shovel boom is of all-welded, full box section construction with rounded edges, and has a wide spread base. Boom point sheaves are extra large and sheave bearings are unusually wide. Shipper shaft pinions are double shrouded. Dipper handle members are of all-welded construction with welded racking, and the handle is connected to the dipper by wide bearing bosses. The gantry can be lowered to cab roof level by paying out on the boom hoist line.

For crane or pile driver service, the Type 111-M is equipped with a heavy-duty box section type boom with steel angles and pipe-section bracing. The boom point section is of goose-neck design which permits minimum radius operation. An independent live boom hoist may be supplied with the Type 111-M for crane service. It is completely independent of all other motions.

Literature Available

AXIAL FLOW PUMPS—Catalog No. G845 is a new bulletin covering axial flow pumps for capacities up to 100,000 GPM and heads to 50 ft. This type of pump is said to provide inexpensive protection against floods, not only for municipalities, but also for large buildings, industrial plants, etc. Other uses are for condenser circulation; sewage plant circulation; irrigation; or where large volumes of water are required at moderate heads. Economy Pumps, Inc., Hamilton, Ohio.

BLOWERS—Roots-Connersville Blower Corp., Connersville, Ind., has just issued Bulletin 22-23-B-12, 24 pages, covering Rotary Positive Blowers. The bulletin covers the many applications for which this type of blower has been found efficient over a long period of years, including: activated sewage disposal plants, supercharging and scavenging of Diesel engines, chemical process industries, pneumatic conveying service, tunnel ventilation, and many others. The blowers are built in a wide range of sizes, from 5 to 50,000 cfm, at pressures up to 30 lb, and for vacuums up to 28 in. Hg.

CENTRIFUGAL PUMPS—Bulletin (No. C-945) covers the horizontal split case, multi-stage, high pressure centrifugal pumps of Economy Pumps, Inc., Hamilton, Ohio. These pumps can be used with motor, steam turbine or engine drives; for high pressure boiler feeding; high pressure water supply in skyscrapers, industrial plants, etc.; hydraulic elevator service. In general, wherever quantities of liquids are to be handled from 75 to 500 psi and capacities from 75 to 400 GPM. These pumps are reported to be adaptable.

COATING—A 12-page bulletin describes Prufcoat. This is said to be an acid-proof, alkali-proof, oil-proof, and water-proof coating for the protection of concrete, structural steel, machinery and equipment. Prufcoat Laboratories, Inc., 63 Main St., Cambridge 42, Mass.

CONCRETE MIXER—Outstanding features of the new Kwik-Mix 11-S Dandie concrete mixer are completely illustrated and described in a new catalog just published by the Kwik-Mix Company, Port Washington, Wis. The new catalog contains 38 photographs and diagrams of the Kwik-Mix 11-cu. ft. mixer. Complete dimensions and condensed specifications are given for the 2-wheel end discharge models and for the 4-wheel 11-S Dandies which are offered either as end or side discharge mixers.

CONVEYOR IDLERS—A new 26-page bulletin on the complete line of Rex Belt Conveyor Idlers carries photographs, tables, charts, diagrams, and cutaway views. Included are the two newest Rex Idlers—the Impact Cushioning Troughing Idler and the Rubber Covered Spiral Return Idler. Bulletin No. 463, Chain Belt Co., 1600 W. Bruce St., Milwaukee 4, Wis.

DIESEL TRACTOR—An illustrated 24-page catalog, No. MS-290A, emphasizing features of the new HD-7 Diesel tractor is being distributed by the Allis-Chalmers Tractor Division, Milwaukee 1, Wis. Displayed are facts about the General Motors 2-cycle engine, the unit injector, transmission construction, and the "Positive" sealed truck wheels. Specifications are included.

EARTH DRILL—The four main types of Buda Earth Drills are described in Bulletin 1237. These include the trailer type, rigid head drill; the truck drill, rigid head and the cradle head and the deep hole drill. All are completely covered in the folder.

FLAME HARDENING—Air Reduction Sales Company, New York 17, N. Y., has published a new catalog No. 90 describing design and use of Airco flame hardening apparatus. Items covered in the catalog vary from simple water-cooled torches and tips for hardening small parts to complete apparatus for use on large jobs. Since all Airco flame hardening apparatus is light in weight and fully portable, it is possible to bring the heat to the work, with the result large parts may often be treated without removal from the assembly.

EXPLOSIVES AND CHEMICALS—A new booklet listing Hercules chemicals and industrial explosives, and more than fifty industries which utilize these products, is now available from Hercules Powder Co., Wilmington, Del. For easy reference, the products are first indexed according to various industries in which the chemicals and explosives are used and then according to chemical families.

INDUSTRIAL GAS MASKS—A new 4-page bulletin describes and illustrates Mine Safety Appliances Company's Industrial Gas Masks for protection against individual industrial gases or combinations of gases, smokes, vapors, and dusts (with the exception of carbon monoxide and illuminating gas). For many applications the masks are U.S. Bureau of Mines Approved. The new bulletin includes the broad selection of canisters available for use with M.S.A. Industrial Gas Masks, and a comprehensive list of gases against which protection is afforded. Mine Safety Appliances Company, Braddock, Thomas, and Meade Sts., Pittsburgh, Pa.

PUMPS—The Quimby Pump Co., 342 Thomas St., Newark, N.J., a division of H. K. Porter Company, Inc., has released a bulletin on "Streamflow" Rotex Pumps which are rotary type, positive displacement pumps used for moderate or low viscosity liquids under medium pressure. They are constructed in either gear-in-head design or external gear and bearings. The folder contains complete specifications, dimensions, and performance charts.

MOTOR GRADERS—In a new booklet, Form 9460, by Caterpillar Tractor Co., Peoria 8, Ill., the story of methods utilized in the many and varied phases of highway construction and maintenance is told and graphically illustrated with the versatility of the all-purpose motor grader illuminated in word and picture.

PUMPS—Bulletin No. B-346, covers vertically split-case, multistage, high-pressure centrifugal pumps. They are usually direct connected to electric motors, but may be driven with small steam turbines, gasoline engines, or chain- or belt-drive arrangements. These pumps can handle quantities of liquids up to 200 lb per sq in. and capacities from 10 to 75 gal per min, and are used for; general water supply, boiler feeding, ice water circulation, brine circulation, pneumatic water systems, sprinkling and similar services. Economy Pumps, Inc., Hamilton, Ohio.

QUARRYING—The multiple demands on Diesel power around a quarry and the solutions are given in a new eight-page booklet, Form 9364, by Caterpillar Tractor Co., Peoria 8, Ill. The publication carries scenes of stripping and excavating, cleaning the stockpile floor and the general quarry area, stockpile loading by track-type tractors; hauling by wheel-type tractors; and the powering of equipment.

ROLLING DOORS—Bulletin No. 46 is the latest literature on Kinnear rolling doors for all installations. Its 40 pages illustrate the many types of doors and give construction features, specifications, and dimensions. Kinnear Manufacturing Co., 1080–90 Fields Ave., Columbus 16, Ohio.